

ERBE Geographic Scene and Monthly Snow Data

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ERBE Geographic Scene and Monthly Snow Data

I. Introduction

The Earth Radiation Budget Experiment (ERBE) is a multisatellite system designed to measure the Earth's radiation budget (see Reference 1). The ERBE data processing system consists of several software packages or subsystems, each designed to perform a particular task. The primary task of the Inversion Subsystem is to reduce satellite altitude radiances to fluxes at the top of the Earth's atmosphere (see References 2 and 3). To accomplish this, angular distribution models (ADMs) are required (see References 4 and 5). These ADMs are a function of viewing and solar geometry and of the scene type as determined by the ERBE scene identification algorithm which is a part of the Inversion Subsystem (see Reference 6).

The Inversion Subsystem uses 12 scene types which are determined by the ERBE scene identification algorithm. The scene type is found by combining the most probable cloud cover, which is determined statistically by the scene identification algorithm, with the underlying geographic scene type as shown in Table 1. The geographic scene types, or geo-scene types, and cloud cover conditions are shown separately in Tables 2 and 3.

Table 1. Inversion Subsystem Scene Types

Scene Type No.	Scene Type	
	Geo-Scene	Cloud Cover
1	Ocean	Clear
2	Land	Clear
3	Snow	Clear
4	Desert	Clear
5	Land-ocean mix	Clear
6	Ocean	Partly-cloudy
7	Land or desert	Partly-cloudy
8	Land-ocean mix	Partly-cloudy
9	Ocean	Mostly-cloudy
10	Land or desert	Mostly-cloudy
11	Land-ocean mix	Mostly-cloudy
12	Any	Overcast

Table 2. Categories of Geographic Scene Type

Geo-Scene Type Index	Description	Character Representation
1	Ocean	O
2	Land	L
3	Snow ^a	S
4	Desert	D
5	Land-ocean	C

a. The snow category includes both snow and ice covered regions. Snow is permanent snow for month, not daily snow.

Table 3. Categories of Cloud Cover Conditions

Cloud Cover Condition Index	Description
1	Clear
2	Partly-cloudy
3	Mostly-cloudy
4	Overcast

Unlike the cloud cover, the geo-scene data are determined prior to operational processing and are stored as ancillary data files. This report describes how the ERBE geo-scene ancillary data were developed and are organized.

Geographic scene data are organized according to colatitudinal and longitudinal regions defined on the Earth equatorial-Greenwich Meridian grid system, the standard ERBE grid system. This grid system is composed of 2.5-deg equal-angle regions with colatitudinal indices (1-72) ranging 180 degrees from north to south and longitudinal indices (1-144) that range from the Greenwich Meridian eastward through 360 degrees (see Reference 7). Each of the 10,368 regions is assigned one of the geo-scene types shown in Table 2. Since the snow coverage for a region varies from month to month, the geo-scene ancillary input data files are provided monthly from November 1984 through February 1990. This period covers the time during which one or more of the ERBE scanner instruments were operating.

II. Procedure

A base map indicating non-snow geographic scene types (geo-scenes 1, 2, 4, and 5 from Table 2) for each region was developed. This base map is discussed below under **Generation of the Baseline Geographic Scene Data**. In addition, a file containing a snow/no-snow indicator for each 2.5-deg region was generated monthly based primarily on data from the National Environmental Satellite Service (NESS) of the National Oceanic and Atmospheric Administration (NOAA) (see Reference 8). Data from these files were merged with the baseline geographic scene data to create monthly geo-scene ancillary input data files used by the ERBE Inversion Subsystem.

III. Generation of the Baseline Geographic Scene Data

A nine track, 1600 bpi magnetic tape containing land and lake elevation and ocean depth data was obtained from the National Center for Atmospheric Research (NCAR) facility in Boulder, Colorado, (see References 9 and 10). The tape contained data for 1-deg equal-angle regions of the Earth. For each region, an integer data field gives the depth or elevation of the region, and a character data field provides the NCAR geographic scene type, "E" for land, "D" for ocean, and "L" for lakes. The data values begin at 89.5 degrees south and 0.5 degrees east and proceed east and then north.

After extracting the geo-scene data from this tape, it was necessary to convert the NCAR character values to values expected by the Inversion Subsystem. The NCAR "E" was changed to "L" to indicate land, and the NCAR "L" and "D" were changed to "O" to indicate ocean.

The NCAR data were also converted from the 1-deg grid to the 2.5-deg grid. This conversion was done by superimposing the 1-deg grid geo-scene data over a 2.5-deg grid. The algorithm looks at 5-deg regions represented by a 5 x 5 matrix as illustrated below.

2.5-deg region						2.5-deg region
1 st Quadrant	(1,1)	(1,2)	(1,3)	(1,4)	(1,5)	2 nd Quadrant
	(2,1)	(2,2)	(2,3)	(2,4)	(2,5)	
-----	(3,1)	(3,2)	(3,3)	(3,4)	(3,5)	-----
	(4,1)	(4,2)	(4,3)	(4,4)	(4,5)	
2.5-deg region	(5,1)	(5,2)	(5,3)	(5,4)	(5,5)	2.5-deg region
3 rd Quadrant						4 th Quadrant

Each element of the matrix represents a 1-deg by 1-deg region and was assigned a value according to the NCAR geo-scene type it contained. Land regions were assigned a value of 0.0,

and ocean regions were assigned a value of 1.0. Each value was then weighted according to its position within a 5 x 5 matrix.

Positions not in the third row or third column were weighted at 100 percent, since they were contained in their entirety in the corresponding 2.5-deg region. Position (3,3), which was divided among all four 2.5-deg regions, was weighted at 25 percent. The remaining positions, each of which were divided between two 2.5-deg regions, were weighted at 50 percent. The weighted values for each region were summed, with the sum indicating the geographic scene type of the 2.5-deg equal angle region. For example, the equation to calculate the sum for the values in the first quadrant of the 5 x 5 matrix would be

$$\begin{aligned} \text{SUM} &= 1.00 * ((1,1) + (1,2) + (2,1) + (2,2)) \\ &+ 0.50 * ((1,3) + (2,3) + (3,1) + (3,2)) \\ &+ 0.25 * (3,3) \end{aligned}$$

The resulting values of SUM were interpreted according to the chart below. The "C" or coastal category was added to account for the land/ocean mix geographic scene type.

SUM Range	Geographic Scene Type
0.00 - 2.00	'L' - Land
2.25 - 4.00	'C' - Land/ocean mix
4.25 - 6.25	'O' - Ocean

Desert regions were identified on a 1-deg by 1-deg grid from an atlas. The desert data were combined with the NCAR geo-scene data to produce a new 180 x 360 matrix, which was converted to a new 72 x 144 matrix using the same technique as before. Desert regions were assigned a value of 0.00, and all other regions were assigned a value of 1.00. 2.5-deg regional sums less than or equal to 3.125 indicated a desert geographic scene type, while sums greater than 3.125 indicated the same geographic scene type as contained in the earlier 72 x 144 matrix containing only the land, ocean and land/ocean mix geographic scene types.

Upon evaluation of these results, members of the ERBE Science Team from the Atmospheric Sciences Division (ASD) at the National Aeronautics and Space Administration (NASA) Langley Research Center determined that the topography should be adjusted for certain 2.5-deg regions. Table 4 shows the original and adjusted geo-scene types for each 2.5-deg region in the ERBE grid system. In the table, "I" is a colatitudinal index that ranges from 1 to 72 going from north to south. "J" is a longitudinal index that ranges from 1 to 144 going eastward from the Greenwich Meridian. The baseline geo-scene types are characterized as "O" (ocean), "L" (land), "D" (desert), and "C" (coastal or ocean/land mix).

Table 4. Adjustments to Geo-Scene Data (Sheet 1 of 4)

Geographic Scene Type			Geographic Scene Type			Geographic Scene Type		
(I,J)	Original	Adjusted	(I,J)	Original	Adjusted	(I,J)	Original	Adjusted
(3,128)	O	C	(7,23)	L	C	(9,16)	O	C
(3,129)	O	C	(7,32)	C	O	(9,27)	L	C
(3,130)	O	C	(7,34)	L	C	(9,30)	L	C
(3,131)	O	C	(7,50)	O	C	(9,73)	L	C
(3,135)	C	O	(7,51)	O	C	(9,99)	L	C
(4,38)	O	C	(7,95)	O	C	(9,100)	L	C
(4,39)	O	C	(7,96)	C	L	(9,101)	L	C
(4,107)	O	C	(7,102)	O	C	(9,103)	L	C
(4,108)	O	C	(7,104)	O	C	(9,104)	C	O
(4,109)	O	C	(7,105)	O	C	(9,105)	L	C
(4,139)	L	C	(7,114)	C	O	(9,106)	L	C
(4,140)	C	O	(7,122)	O	C	(9,109)	L	C
(5,5)	O	C	(7,136)	L	C	(9,114)	O	C
(5,40)	L	C	(7,137)	L	O	(9,115)	L	C
(5,103)	O	C	(8,10)	O	C	(9,133)	L	C
(5,104)	O	C	(8,12)	O	C	(10,17)	L	C
(5,106)	C	O	(8,23)	O	C	(10,18)	L	C
(5,115)	C	L	(8,53)	L	C	(10,76)	L	C
(5,116)	O	C	(8,54)	L	C	(10,79)	L	C
(5,137)	L	C	(8,55)	L	C	(10,96)	O	C
(5,138)	C	O	(8,56)	L	C	(10,111)	L	C
(6,40)	L	C	(8,85)	C	O	(10,114)	C	O
(6,96)	O	C	(8,95)	O	C	(10,115)	L	C
(6,97)	O	C	(8,96)	O	C	(10,116)	C	L
(6,98)	O	C	(8,97)	O	C	(10,127)	L	C
(6,107)	L	C	(8,104)	L	O	(11,72)	L	C
(6,108)	L	C	(8,106)	L	C	(11,76)	C	O
(6,113)	L	C	(8,108)	L	O	(11,77)	C	O
(6,137)	L	O	(8,109)	L	C	(11,79)	L	C
(6,138)	C	O	(8,136)	L	C	(11,80)	L	C
(7,22)	O	C	(9,14)	C	L	(11,111)	L	C

Table 4. Adjustments to Geo-Scene Data (Sheet 2 of 4)

Geographic Scene Type			Geographic Scene Type			Geographic Scene Type		
(I,J)	Original	Adjusted	(I,J)	Original	Adjusted	(I,J)	Original	Adjusted
(11,116)	L	C	(15,122)	L	C	(22,144)	O	C
(11,118)	L	C	(15,142)	L	C	(23,53)	L	C
(11,128)	L	C	(16,1)	L	C	(23,141)	O	C
(11,136)	O	C	(16,57)	L	C	(24,7)	D	C
(12,9)	L	C	(16,143)	L	C	(24,8)	D	C
(12,13)	L	C	(17,58)	C	O	(24,12)	D	C
(12,63)	L	C	(17,95)	L	C	(24,13)	D	C
(12,65)	L	C	(17,110)	L	C	(24,14)	D	C
(12,70)	O	C	(17,121)	O	C	(24,99)	L	C
(12,107)	L	C	(17,123)	L	C	(25,12)	L	C
(13,5)	L	C	(18,20)	D	C	(25,21)	L	C
(13,13)	C	L	(18,22)	D	C	(25,49)	L	C
(13,57)	L	C	(18,111)	L	C	(25,100)	L	C
(13,63)	C	O	(18,119)	L	C	(25,106)	L	C
(13,64)	L	C	(18,144)	L	C	(25,107)	C	O
(13,81)	L	C	(19,3)	L	C	(25,108)	C	O
(13,83)	L	C	(19,58)	L	C	(25,140)	D	C
(13,89)	O	C	(19,141)	O	C	(26,21)	D	O
(13,107)	L	C	(19,143)	O	C	(26,23)	L	C
(13,117)	L	C	(20,1)	L	C	(26,139)	D	C
(13,118)	L	C	(20,12)	O	C	(27,16)	D	C
(14,4)	O	C	(20,20)	D	C	(27,47)	L	C
(14,56)	L	O	(20,22)	D	C	(27,49)	L	C
(14,65)	C	L	(20,57)	L	C	(27,102)	L	C
(14,109)	L	C	(20,115)	L	C	(27,138)	D	C
(14,120)	L	C	(21,7)	O	C	(28,36)	O	C
(15,3)	O	C	(21,20)	D	C	(28,44)	L	C
(15,7)	C	L	(21,57)	L	C	(28,45)	L	C
(15,44)	L	C	(21,95)	O	C	(28,113)	O	C
(15,63)	L	C	(22,5)	C	O	(28,138)	D	C
(15,64)	C	L	(22,49)	O	C	(29,17)	D	C
(15,113)	L	C	(22,98)	L	D	(29,23)	L	C

Table 4. Adjustments to Geo-Scene Data (Sheet 3 of 4)

Geographic Scene Type			Geographic Scene Type			Geographic Scene Type		
(I,J)	Original	Adjusted	(I,J)	Original	Adjusted	(I,J)	Original	Adjusted
(29,49)	O	C	(32,40)	L	C	(44,117)	L	D
(29,107)	O	C	(32,42)	L	C	(44,118)	L	D
(29,116)	L	C	(32,110)	L	C	(45,47)	D	C
(30,1)	L	D	(33,40)	L	C	(45,60)	L	C
(30,2)	L	D	(33,51)	O	C	(45,117)	L	D
(30,3)	L	D	(33,139)	O	C	(45,118)	L	D
(30,4)	L	D	(34,2)	O	C	(45,128)	L	C
(30,5)	L	D	(34,20)	D	C	(46,46)	D	C
(30,6)	L	D	(34,140)	O	C	(46,116)	D	O
(30,7)	L	D	(35,4)	O	C	(46,117)	L	D
(30,8)	L	D	(35,46)	L	C	(46,118)	L	D
(30,9)	L	D	(36,18)	D	C	(46,126)	L	C
(30,10)	L	D	(36,40)	L	C	(47,46)	D	C
(30,11)	L	D	(37,4)	O	C	(47,116)	D	C
(30,12)	L	D	(37,43)	C	O	(47,117)	L	D
(30,13)	L	D	(37,48)	O	C	(47,118)	L	D
(30,14)	L	D	(37,126)	L	C	(47,125)	L	C
(30,19)	L	D	(38,41)	C	O	(48,116)	D	C
(30,20)	L	D	(39,46)	C	O	(48,117)	L	D
(30,139)	L	D	(39,56)	L	C	(49,52)	L	C
(30,140)	L	D	(40,6)	L	C	(49,53)	L	C
(30,141)	L	D	(40,57)	L	C	(49,117)	L	D
(30,142)	L	D	(40,113)	L	C	(49,124)	L	C
(30,143)	L	D	(41,13)	C	D	(50,55)	L	C
(31,4)	L	D	(42,17)	O	C	(50,117)	L	D
(31,6)	L	C	(42,58)	L	C	(50,123)	L	C
(31,19)	L	C	(43,5)	O	C	(51,122)	C	O
(31,40)	L	C	(43,50)	D	C	(52,120)	L	C
(31,109)	L	C	(43,56)	O	C	(53,119)	D	C
(31,111)	L	C	(43,57)	L	C	(55,68)	L	C
(32,18)	D	C	(43,117)	L	D	(55,118)	D	C
(32,20)	D	C	(44,15)	O	C	(56,114)	D	O

Table 4. Adjustments to Geo-Scene Data (Sheet 4 of 4)

Geographic Scene Type			Geographic Scene Type			Geographic Scene Type		
(I,J)	Original	Adjusted	(I,J)	Original	Adjusted	(I,J)	Original	Adjusted
(56,118)	D	C	(67,86)	O	C	(69,69)	L	O
(57,115)	C	L	(67,119)	L	C	(69,70)	L	O
(57,117)	L	C	(67,120)	L	O	(69,71)	L	O
(57,121)	O	C	(67,121)	L	O	(69,72)	L	O
(58,115)	O	C	(67,122)	L	O	(69,73)	L	O
(62,121)	O	C	(67,133)	O	C	(69,74)	L	O
(63,34)	C	O	(68,65)	L	C	(69,75)	L	O
(63,41)	L	C	(68,66)	L	C	(69,76)	L	O
(63,44)	O	C	(68,67)	L	O	(69,77)	L	O
(63,48)	O	C	(68,68)	L	O	(69,78)	L	O
(63,49)	O	C	(68,69)	L	O	(69,79)	L	O
(63,118)	O	C	(68,70)	L	O	(69,80)	L	O
(64,29)	C	O	(68,71)	L	O	(69,81)	L	O
(64,30)	C	O	(68,72)	L	O	(69,82)	L	O
(64,61)	L	C	(68,73)	L	O	(69,83)	L	C
(64,90)	C	O	(68,74)	L	O	(69,84)	L	C
(65,1)	L	C	(68,75)	L	O	(70,69)	L	C
(65,66)	C	L	(68,76)	L	O	(70,70)	L	C
(65,67)	C	L	(68,77)	L	O	(70,71)	L	C
(65,115)	O	C	(68,78)	L	O	(70,72)	L	C
(65,116)	C	L	(68,79)	L	O	(70,73)	L	C
(65,117)	L	C	(68,80)	L	C	(70,74)	L	O
(65,120)	L	C	(68,81)	L	O	(70,75)	L	O
(65,140)	O	C	(68,82)	L	C	(70,76)	L	O
(65,141)	O	C	(68,125)	L	C	(70,77)	L	O
(65,143)	L	C	(68,126)	L	C	(70,78)	L	O
(66,98)	C	O	(68,127)	L	C	(70,79)	L	O
(66,99)	C	O	(68,128)	L	C	(70,80)	L	O
(66,104)	O	C	(68,129)	L	C	(70,81)	L	O
(66,105)	O	C	(69,65)	L	C	(70,82)	L	O
(66,120)	L	C	(69,66)	L	O	(70,83)	L	C
(66,121)	C	O	(69,67)	L	O			
(66,136)	O	C	(69,68)	L	O			

The final baseline geo-scene matrix for ocean, land, desert, and coastal includes the modifications made within the Andes mountain range where certain land regions were changed to the desert. Figure 1 shows the baseline geo-scene map that contains no snow. Figure 2 shows the character representations of the baseline map (see Table 2).

IV. Addition of Snow to Baseline Geographic Scene Data

The snow and ice data included on the monthly geographic scene type map comes from various sources. Snow and ice data for the Northern Hemisphere are obtained from the satellite-derived Northern Hemisphere Weekly Snow and Ice Cover chart produced by the NESS/ NOAA. These data are temporally organized by week and spatially organized according to a 1:50,000,000 polar stereographic projection of the Northern Hemisphere. Reference 11 contains a detailed discussion of the generation of these weekly maps. Additional ice data for the Northern Hemisphere are derived from documentation provided by the NASA/Goddard Space Flight Center (see Reference 12). Likewise, ice data for the Southern Hemisphere are derived from similar documentation (see Reference 13). Since none of these sources provide the snow and ice data in a format usable by the Inversion Subsystem software, some preprocessing is required.

Preparation of the Northern Hemisphere snow requires both a conversion from the polar stereographic grid to the ERBE 2.5-deg equal angle-grid and a conversion from weekly data to monthly data. To begin the grid conversion, a technique that maps the center of a 2.5-deg ERBE region to the region on the polar stereographic grid that contains that center is employed. Discretization problems can arise with this technique that can result in an ERBE region being incorrectly labeled as a snow region at the edge of the snow line. The software that performs this mapping technique was designed to correct for this scenario.

Once the grid conversion has taken place, the weekly data can be converted to monthly data. In order for an ERBE region to be labeled as snow for a month, that region must be labeled as snow for each week of the month. This is done to minimize errors produced when retrieving values from the shortwave and longwave bidirectional models. A smaller error in flux is produced if a region is covered in snow and the bidirectional model for land is used than if the region is not covered with snow and the snow bidirectional model is used.

The ice data for both the Northern and Southern Hemispheres are based on NASA observations from 1973 to 1976 described in References 12 and 13. For a given month of the year, the sea ice extent (latitude of the ocean-ice line for a given longitude) was taken to be the minimum sea ice extent during the data period available. The continent of Antarctica was taken to be snow covered, except for the edges, which are coast. Snow in South America was ignored.

Table 5 summarizes the process used to generate the ERBE monthly geo-scene ancillary input data.

ERBE scanner data were processed from November 1984 through February 1990. Individual geo-scene maps for each of these 64 months can be accessed over the World Wide Web through the Langley Technical Report Server .

ERBE Geographic Scene Map

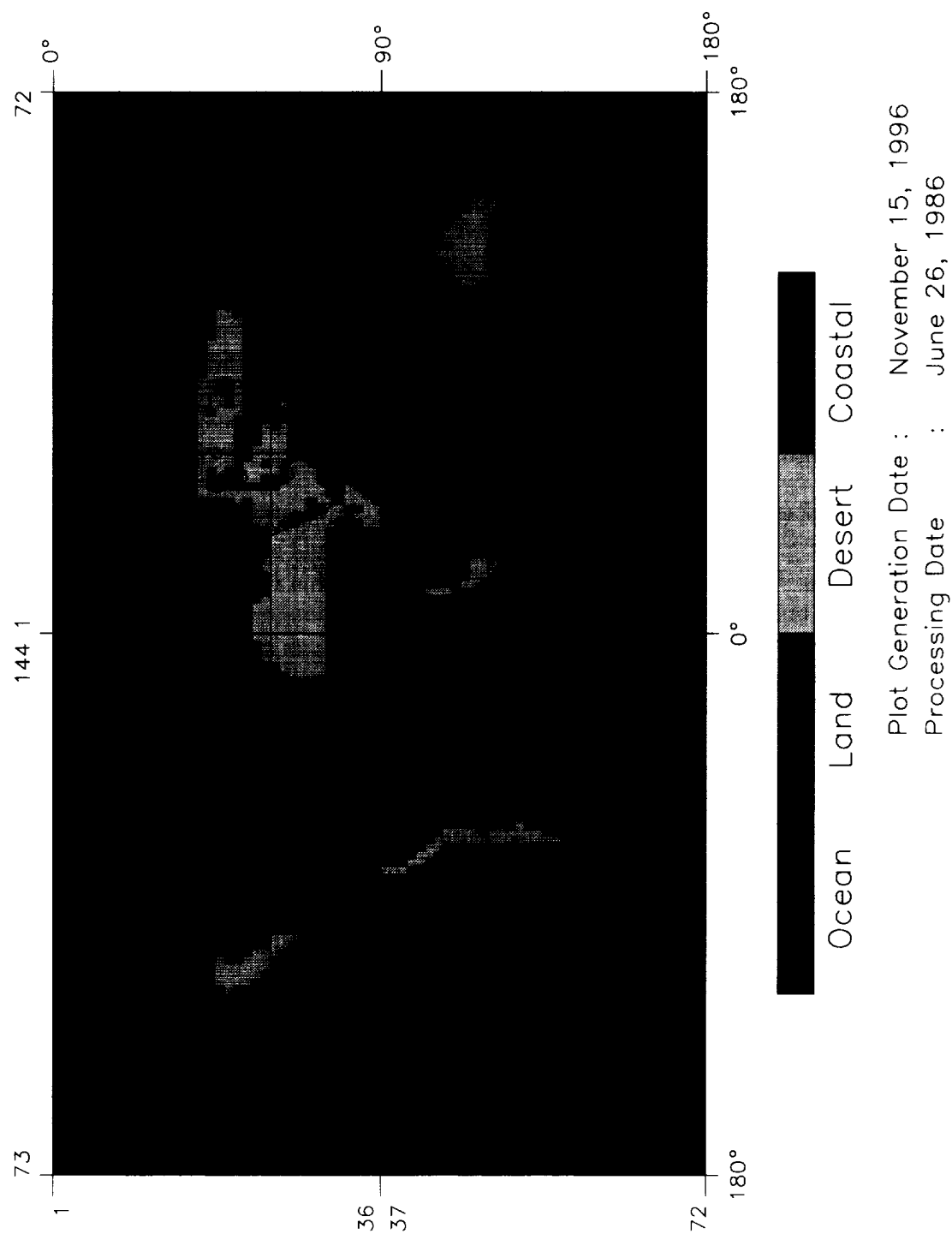


Figure 1. Baseline Geo-Scene Map

	10	20	30	40	50	60	70	80	90	100	110	120	130	140
1	O	O	O	O	O	O	O	O	O	O	O	O	O	O
2	O	O	O	O	O	O	O	O	O	O	O	O	O	O
3	O	O	O	O	O	O	O	O	O	O	O	O	O	O
4	O	O	O	O	O	O	O	O	O	O	O	O	O	O
5	O	O	O	O	O	O	O	O	O	O	O	O	O	O
6	O	O	O	O	O	O	O	O	O	O	O	O	O	O
7	O	O	O	O	O	O	O	O	O	O	O	O	O	O
8	O	O	O	O	O	O	O	O	O	O	O	O	O	O
9	O	O	O	O	O	O	O	O	O	O	O	O	O	O
10	O	O	O	O	O	O	O	O	O	O	O	O	O	O
11	O	O	O	O	O	O	O	O	O	O	O	O	O	O
12	O	O	O	O	O	O	O	O	O	O	O	O	O	O
13	O	O	O	O	O	O	O	O	O	O	O	O	O	O
14	O	O	O	O	O	O	O	O	O	O	O	O	O	O
15	O	O	O	O	O	O	O	O	O	O	O	O	O	O
16	O	O	O	O	O	O	O	O	O	O	O	O	O	O
17	O	O	O	O	O	O	O	O	O	O	O	O	O	O
18	O	O	O	O	O	O	O	O	O	O	O	O	O	O
19	O	O	O	O	O	O	O	O	O	O	O	O	O	O
20	O	O	O	O	O	O	O	O	O	O	O	O	O	O
21	O	O	O	O	O	O	O	O	O	O	O	O	O	O
22	O	O	O	O	O	O	O	O	O	O	O	O	O	O
23	O	O	O	O	O	O	O	O	O	O	O	O	O	O
24	O	O	O	O	O	O	O	O	O	O	O	O	O	O
25	O	O	O	O	O	O	O	O	O	O	O	O	O	O
26	O	O	O	O	O	O	O	O	O	O	O	O	O	O
27	O	O	O	O	O	O	O	O	O	O	O	O	O	O
28	O	O	O	O	O	O	O	O	O	O	O	O	O	O
29	O	O	O	O	O	O	O	O	O	O	O	O	O	O
30	O	O	O	O	O	O	O	O	O	O	O	O	O	O
31	O	O	O	O	O	O	O	O	O	O	O	O	O	O
32	O	O	O	O	O	O	O	O	O	O	O	O	O	O
33	O	O	O	O	O	O	O	O	O	O	O	O	O	O
34	O	O	O	O	O	O	O	O	O	O	O	O	O	O
35	O	O	O	O	O	O	O	O	O	O	O	O	O	O
36	O	O	O	O	O	O	O	O	O	O	O	O	O	O
37	O	O	O	O	O	O	O	O	O	O	O	O	O	O
38	O	O	O	O	O	O	O	O	O	O	O	O	O	O
39	O	O	O	O	O	O	O	O	O	O	O	O	O	O
40	O	O	O	O	O	O	O	O	O	O	O	O	O	O
41	O	O	O	O	O	O	O	O	O	O	O	O	O	O
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43	O	O	O	O	O	O	O	O	O	O	O	O	O	O
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45	O	O	O	O	O	O	O	O	O	O	O	O	O	O
46	O	O	O	O	O	O	O	O	O	O	O	O	O	O
47	O	O	O	O	O	O	O	O	O	O	O	O	O	O
48	O	O	O	O	O	O	O	O	O	O	O	O	O	O
49	O	O	O	O	O	O	O	O	O	O	O	O	O	O
50	O	O	O	O	O	O	O	O	O	O	O	O	O	O
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52	O	O	O	O	O	O	O	O	O	O	O	O	O	O
53	O	O	O	O	O	O	O	O	O	O	O	O	O	O
54	O	O	O	O	O	O	O	O	O	O	O	O	O	O
55	O	O	O	O	O	O	O	O	O	O	O	O	O	O
56	O	O	O	O	O	O	O	O	O	O	O	O	O	O
57	O	O	O	O	O	O	O	O	O	O	O	O	O	O
58	O	O	O	O	O	O	O	O	O	O	O	O	O	O
59	O	O	O	O	O	O	O	O	O	O	O	O	O	O
60	O	O	O	O	O	O	O	O	O	O	O	O	O	O
61	O	O	O	O	O	O	O	O	O	O	O	O	O	O
62	O	O	O	O	O	O	O	O	O	O	O	O	O	O
63	O	O	O	O	O	O	O	O	O	O	O	O	O	O
64	O	O	O	O	O	O	O	O	O	O	O	O	O	O
65	O	O	O	O	O	O	O	O	O	O	O	O	O	O
66	O	O	O	O	O	O	O	O	O	O	O	O	O	O
67	O	O	O	O	O	O	O	O	O	O	O	O	O	O
68	O	O	O	O	O	O	O	O	O	O	O	O	O	O
69	O	O	O	O	O	O	O	O	O	O	O	O	O	O
70	O	O	O	O	O	O	O	O	O	O	O	O	O	O
71	O	O	O	O	O	O	O	O	O	O	O	O	O	O
72	O	O	O	O	O	O	O	O	O	O	O	O	O	O
	Key: O Ocean L Land D Desert C Coastal													

Figure 2. Baseline Geo-Scene Map, Character Representation

Table 5. Geographic Scene Type Matrix Generation Summary

Step	Inputs	Processes	Output
1	NCAR tape	Extract geographic scene types for 1-deg regions. Convert NCAR characters to standard ERBE characters.	A - 180 x 360 matrix with the ERBE land and ocean geographic scene types
2	Output A	Convert 1-deg data to 2.5-deg data.	B - 72 x 144 matrix with land, ocean, and land/ocean mix geographic scene types
3	Output A 180 x 360 matrix with desert and other vegetative geographic scene types	Redefine land and ocean regions as desert where appropriate.	C - 180 x 360 matrix with land, ocean, and desert geographic scene types
4	Output B Output C	Convert 1-deg data from Output C to 2.5-deg data. Redefine 2.5-deg regions from Output B as desert where appropriate.	D - 72 x 144 matrix with land, ocean, land/ocean mix, and desert geographic scene types
5	Output D	Redefine geographic scene types as directed by the ERBE Science Team.	E - modified version of Output D
6	Output E Monthly 72 x 144 matrix indicating which regions are snow covered	Redefine regions as the snow geographic scene type where appropriate.	F - Monthly 72 x 144 matrix with land, ocean, land/ocean mix, desert, and snow geographic scene types

V. Monthly Composite Geographic Scene Data

ERBE nonscanner data are available from November 1984 to the present time, and production data processing is ongoing. The nonscanner inversion algorithm uses monthly composite geo-scene data as opposed to the individual monthly data sets discussed in the previous section. These twelve monthly composite geo-scene files use the same underlying baseline geo-scene data as do the individual monthly files. In general, for a region to be categorized as snow in a monthly composite file, that region must contain snow during each month for the years 1985 through 1989. However, the Science Team requested that all land regions in Antarctica (2.5-deg zones 61-72) be changed to snow regions for the January, March, April, and October composite files.

Figures 3 through 14 show the 12 monthly composite geo-scene data sets that are used for ERBE nonscanner data processing. Figures 15 through 26 show the same data in a character representation.

The 12 monthly composite geo-scene data sets are also available over the World Wide Web through the Langley Technical Report Server.

VI. Concluding Remarks

The technique described in this report was used to prepare geographic scene data for each month from November 1984 through February 1990. These monthly data files were used in the production processing of ERBE scanner data products which are archived at the Langley Distributed Active Archive Center (DAAC). The monthly composite geographic scene data presented in this report were used in the production processing of ERBE nonscanner data products which continue to be processed and archived at the Langley DAAC.

This report is available over the World Wide Web through the Langley Technical Report Server.

ERBE Composite Geographic Scene Snow Data January 1985–1989

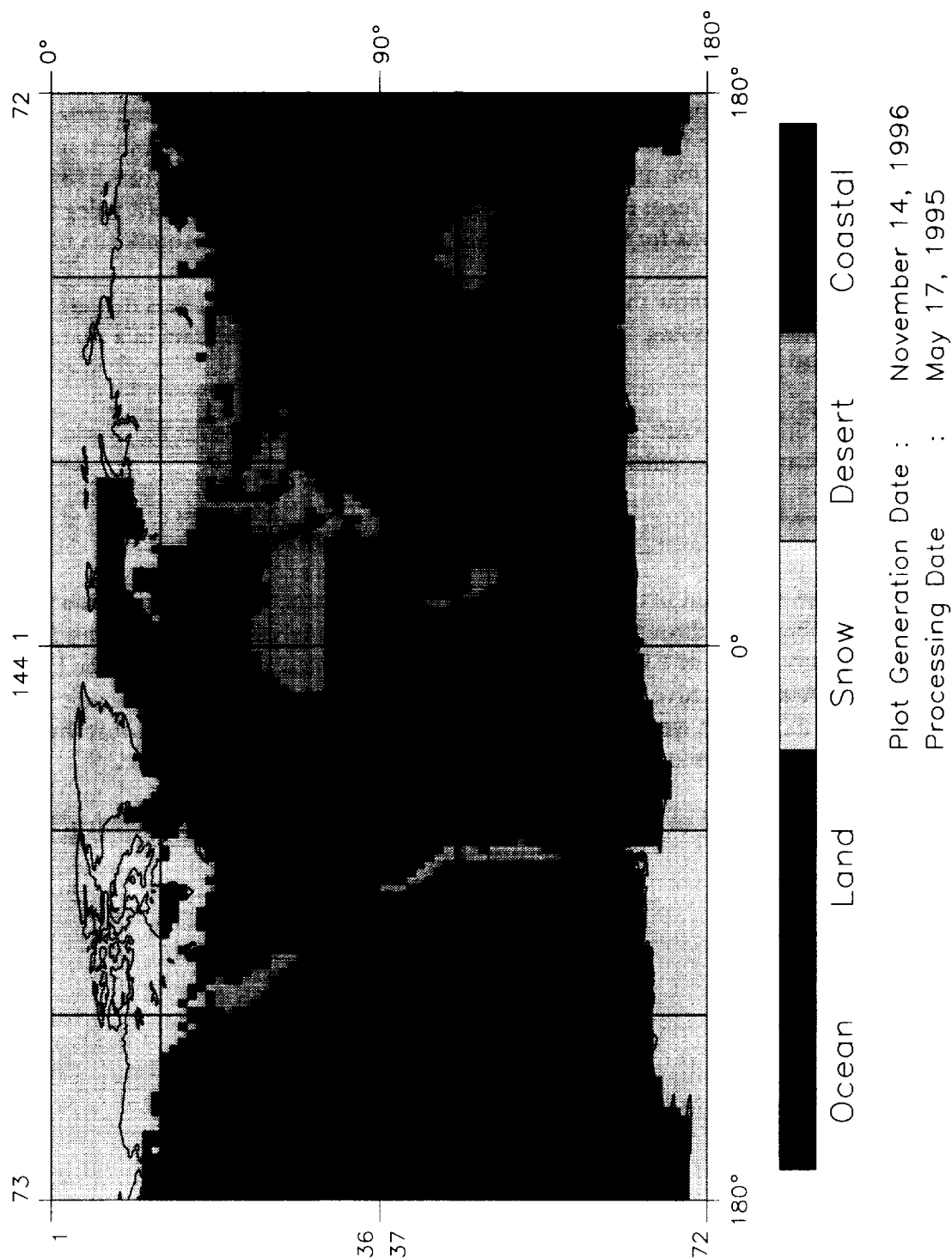


Figure 3. Composite Geo-Scene Map (January 1985-1989)

ERBE Composite Geographic Scene Snow Data February 1985–1989

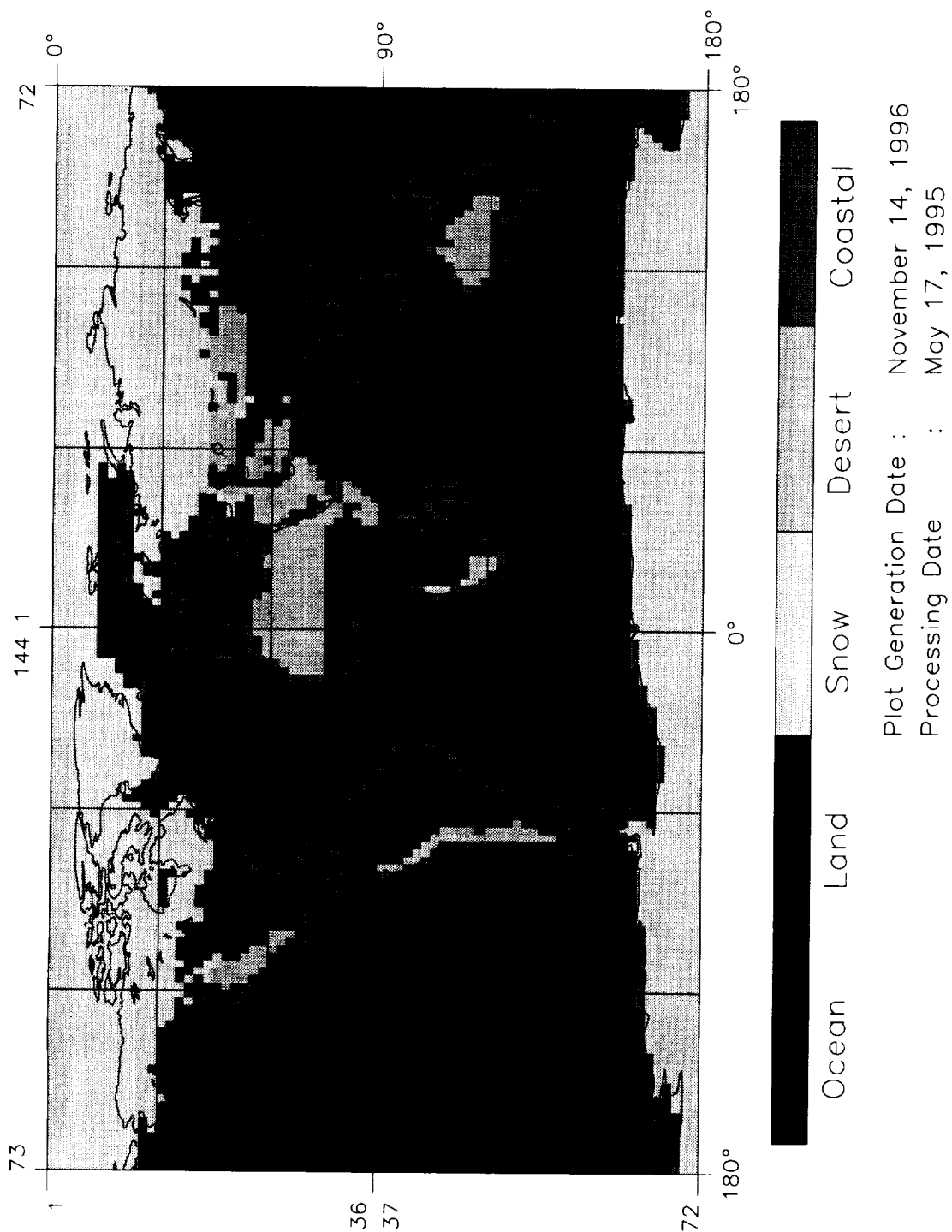


Figure 4. Composite Geo-Scene Map (February 1985-1989)

ERBE Composite Geographic Scene Snow Data

March 1985–1989

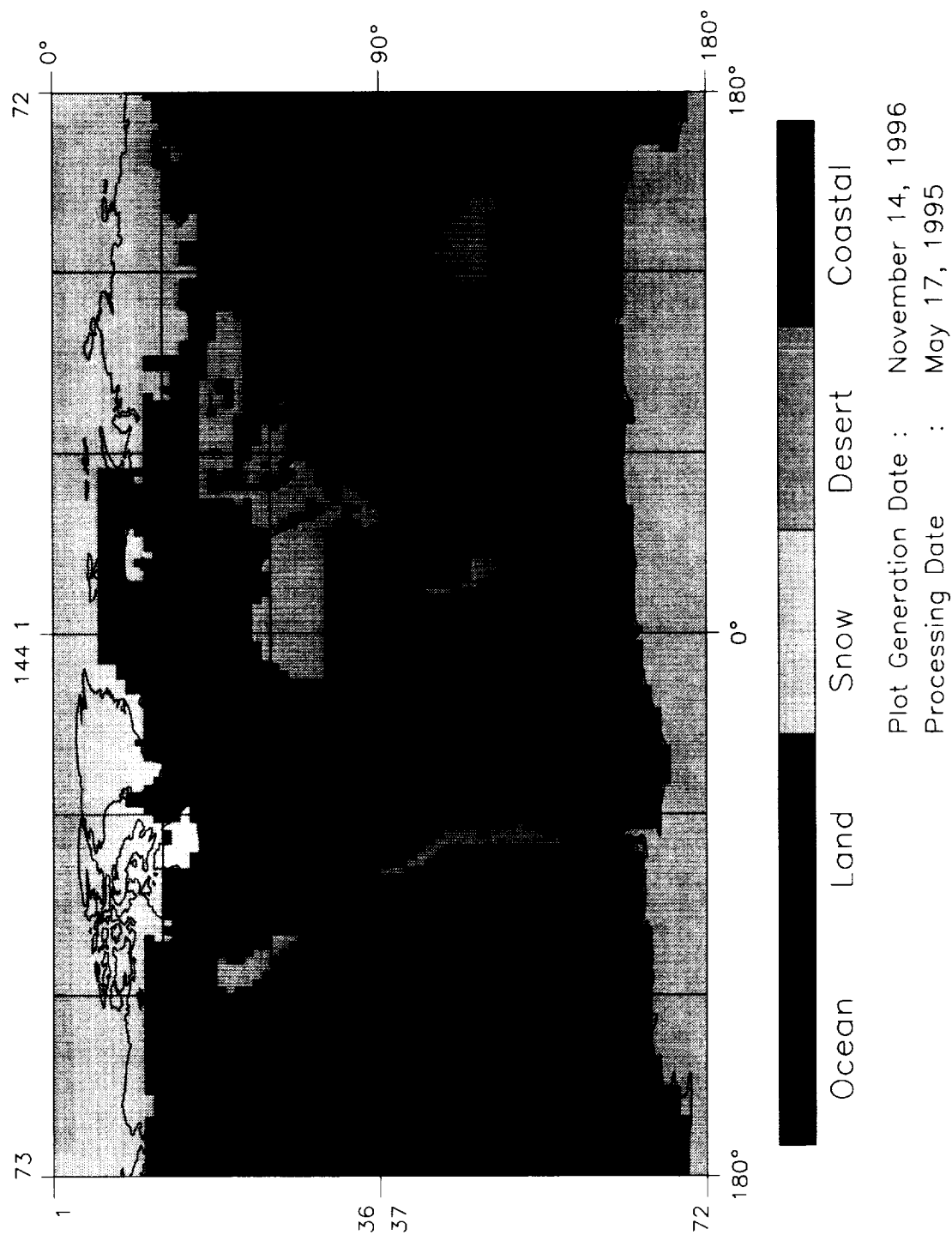


Figure 5. Composite Geo-Scene Map (March 1985-1989)

ERBE Composite Geographic Scene Snow Data April 1985–1989

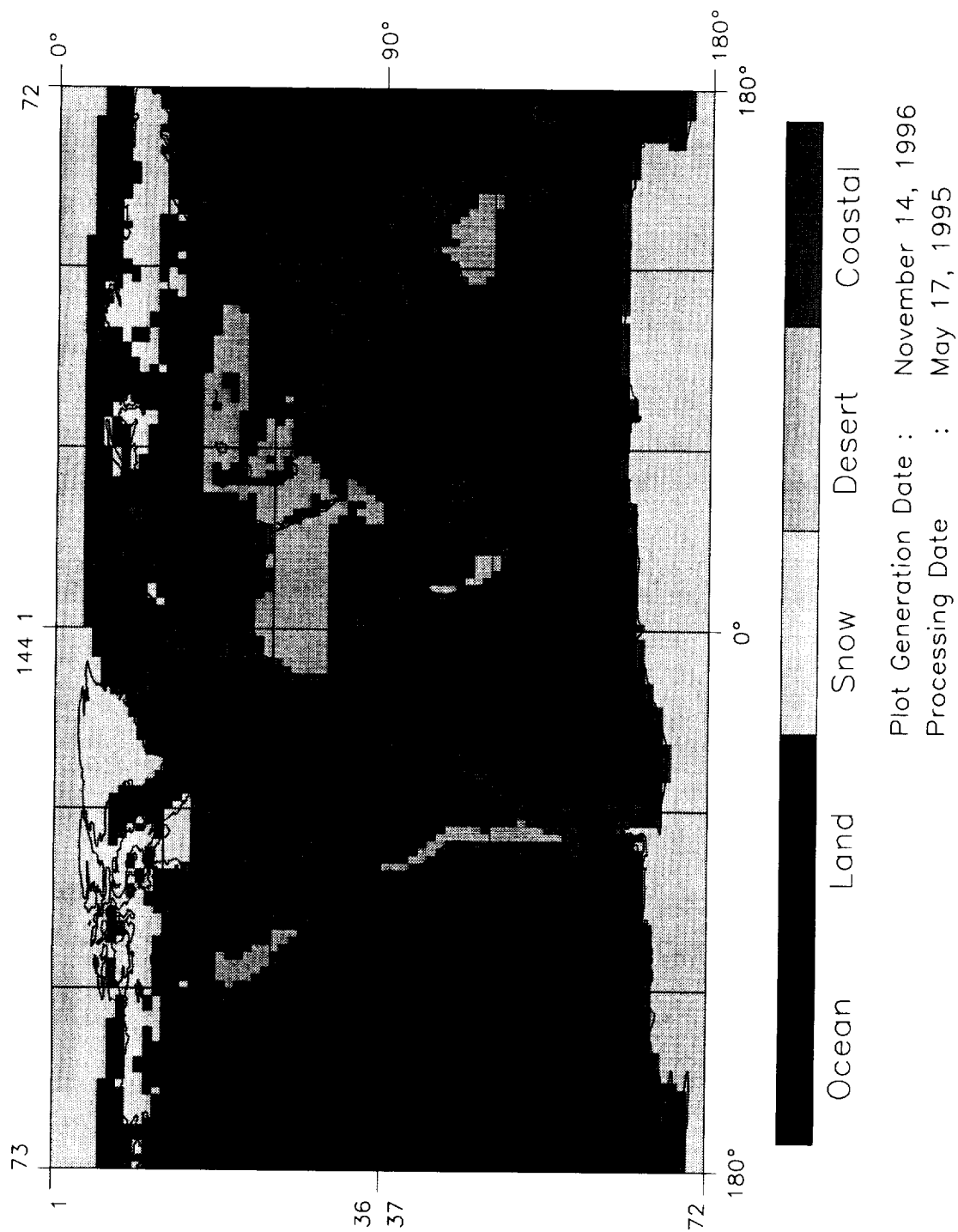


Figure 6. Composite Geo-Scene Map (April 1985-1989)

ERRE Composite Geographic Scene Snow Data May 1985-1989

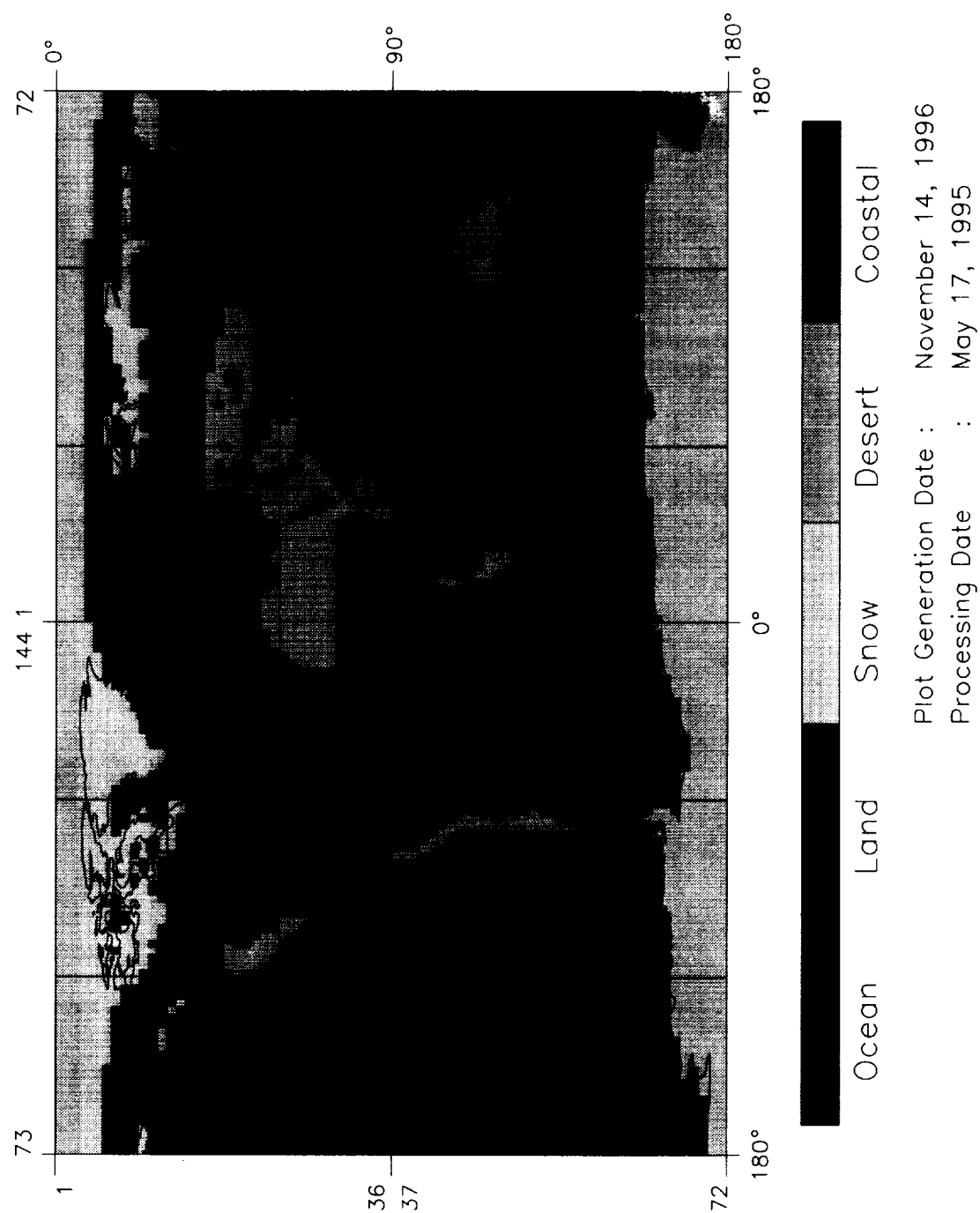


Figure 7. Composite Geo-Scene Map (May 1985-1989)

ERBE Composite Geographic Scene Snow Data June 1985–1989

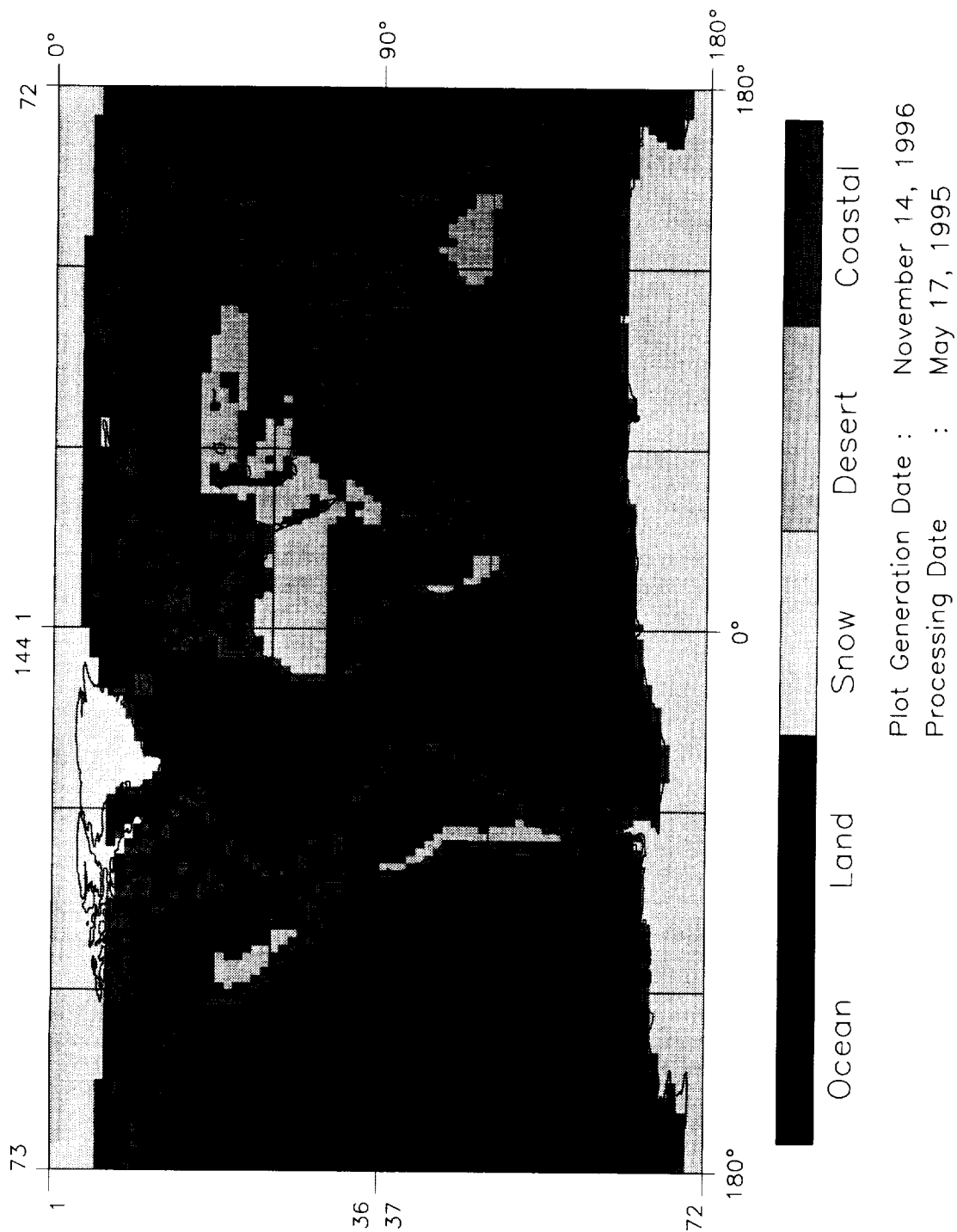


Figure 8. Composite Geo-Scene Map (June 1985-1989)

ERBE Composite Geographic Scene Snow Data July 1985–1989

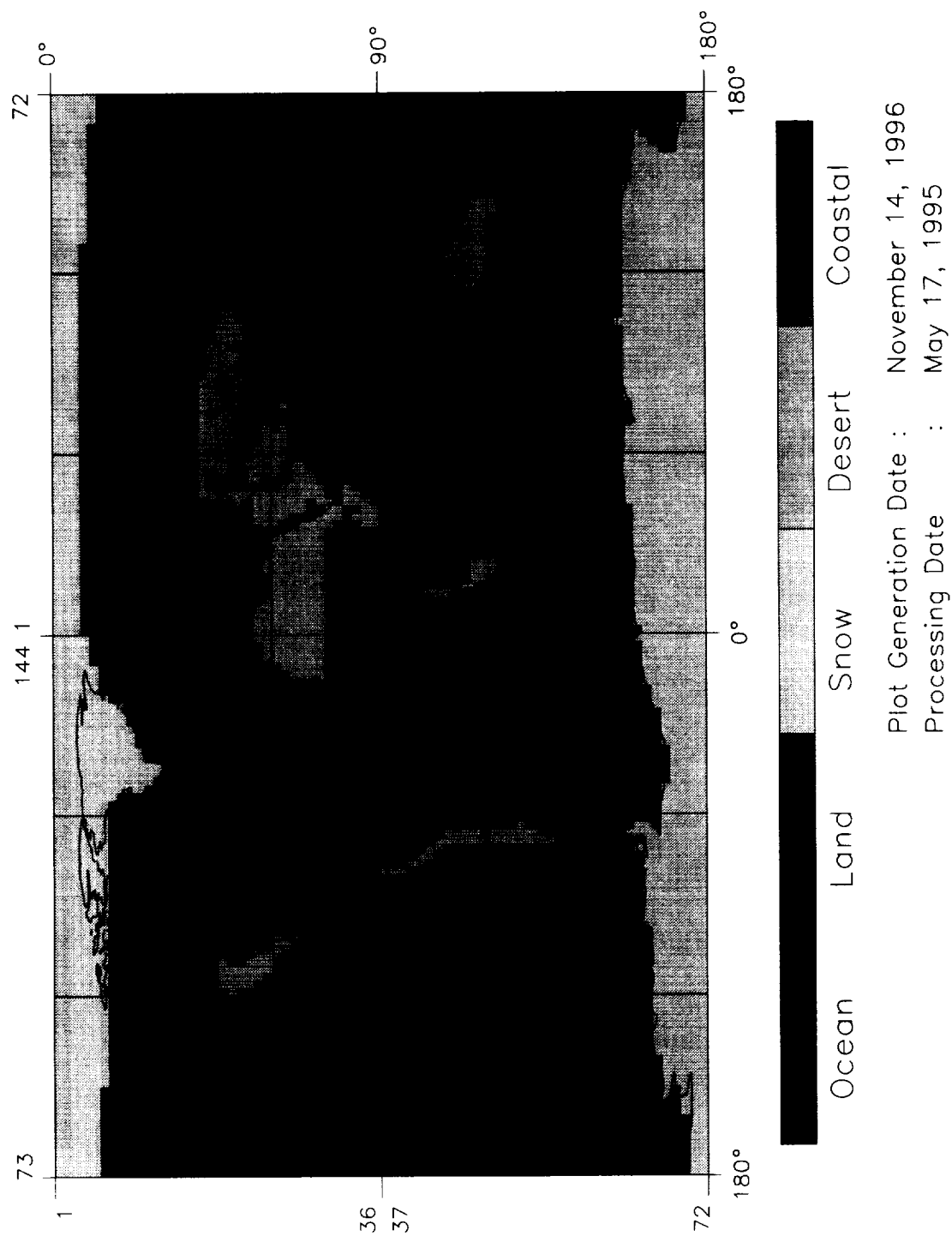


Figure 9. Composite Geo-Scene Map (July 1985-1989)

ERBE Composite Geographic Scene Snow Data

August 1985–1989

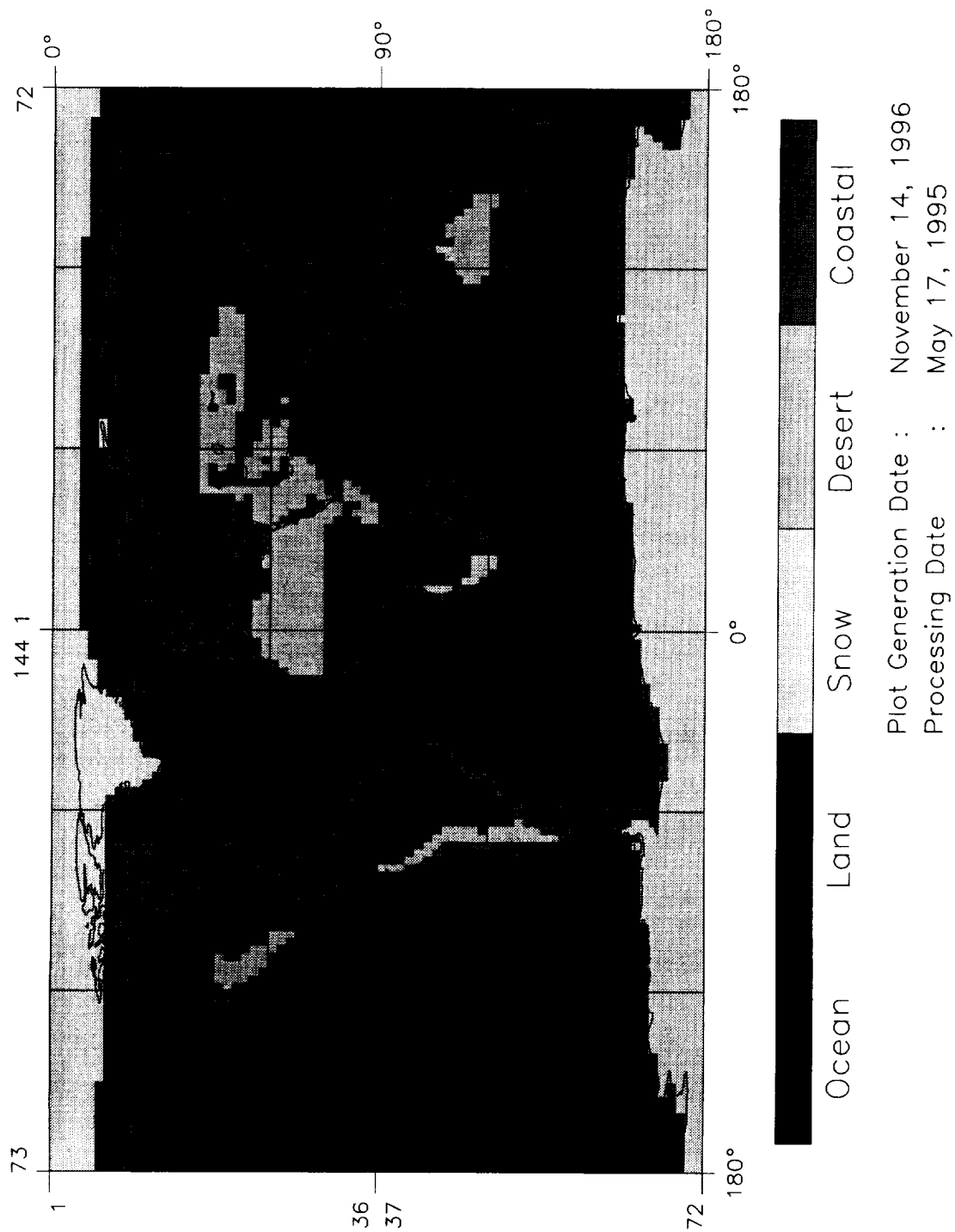


Figure 10. Composite Geo-Scene Map (August 1985-1989)

ERBE Composite Geographic Scene Snow Data September 1985–1989

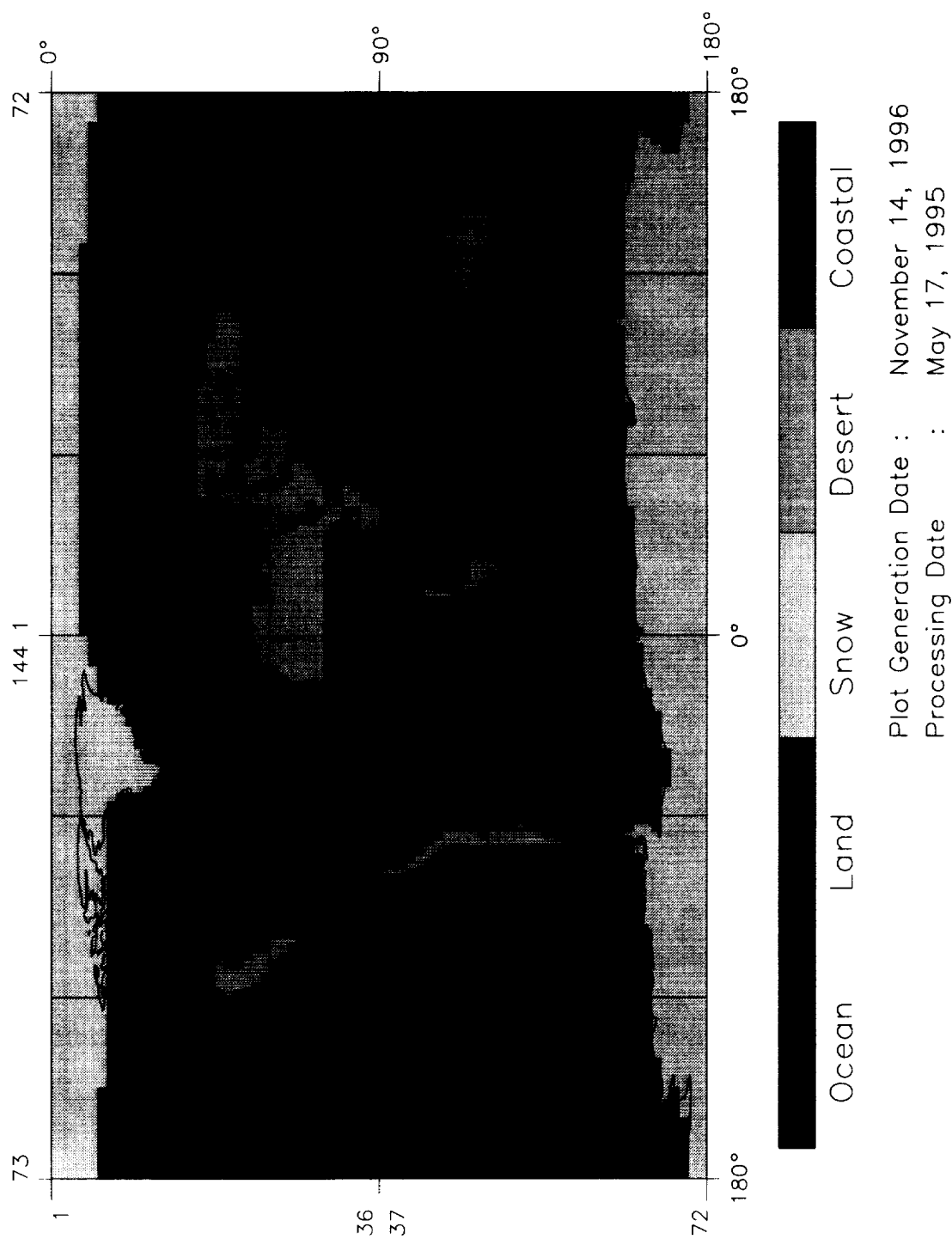


Figure 11. Composite Geo-Scene Map (September 1985-1989)

ERBE Composite Geographic Scene Snow Data October 1985–1989

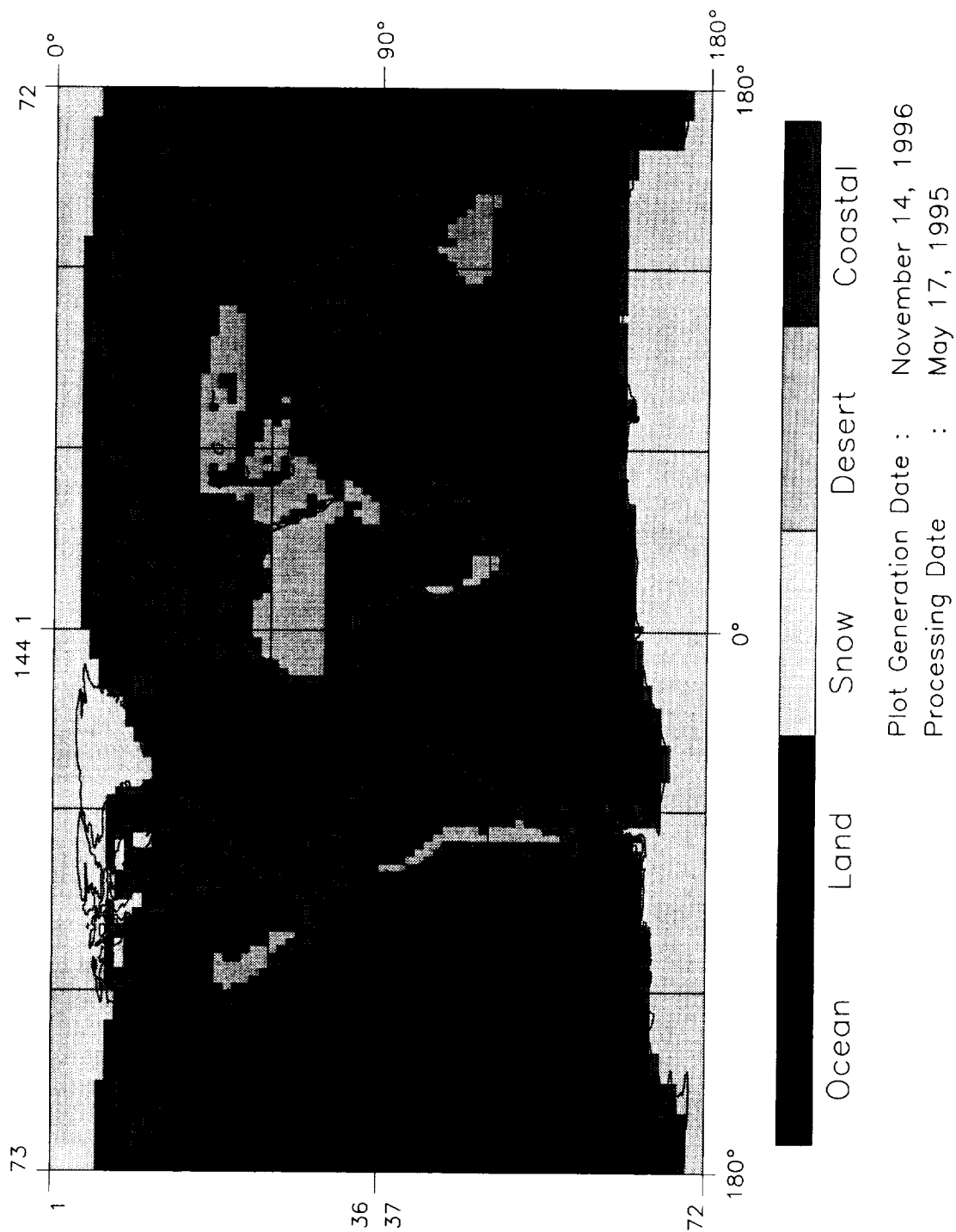


Figure 12. Composite Geo-Scene Map (October 1985-1989)

ERBE Composite Geographic Scene Snow Data

November 1985–1989

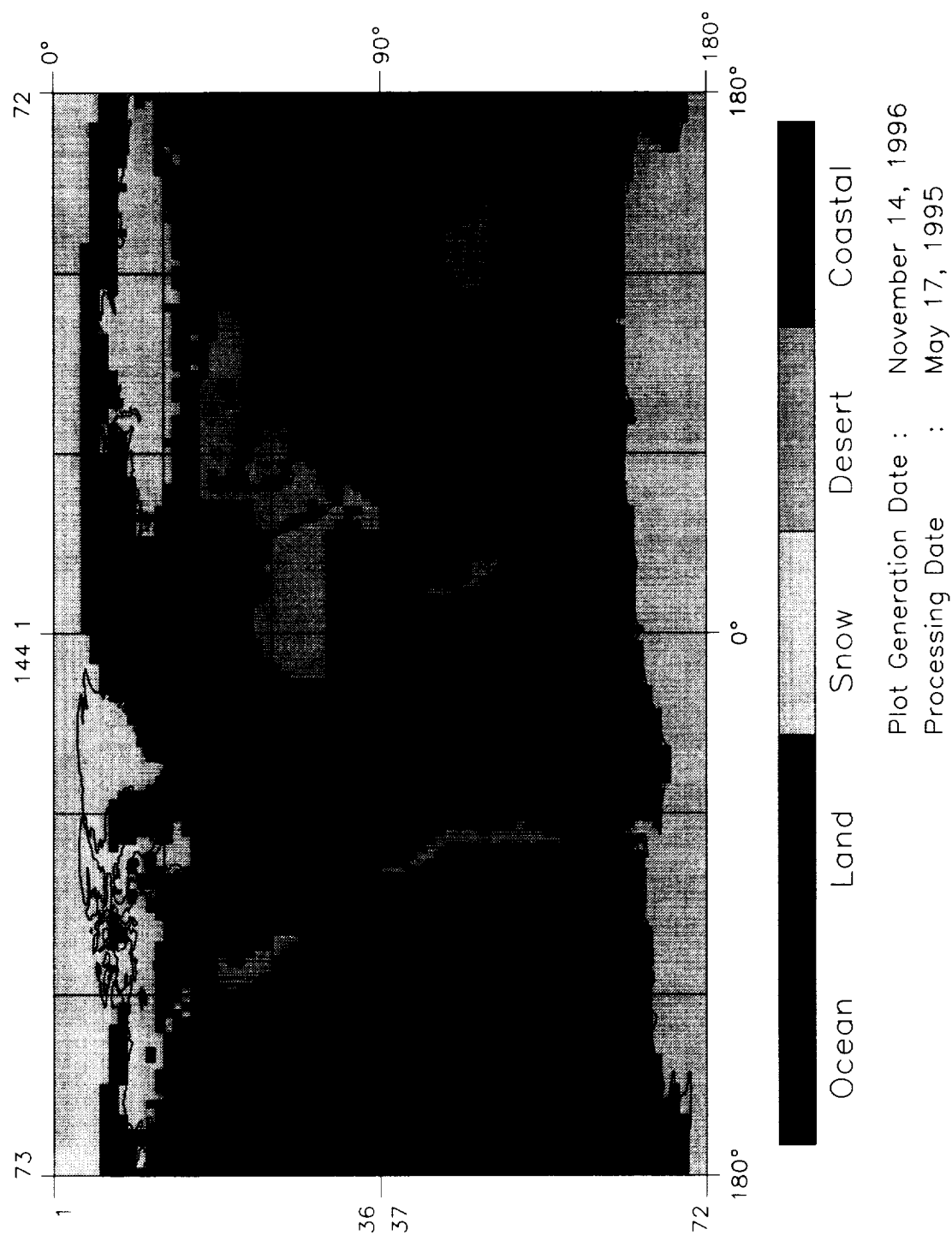


Figure 13. Composite Geo-Scene Map (November 1985-1989)

ERBE Composite Geographic Scene Snow Data December 1985–1989

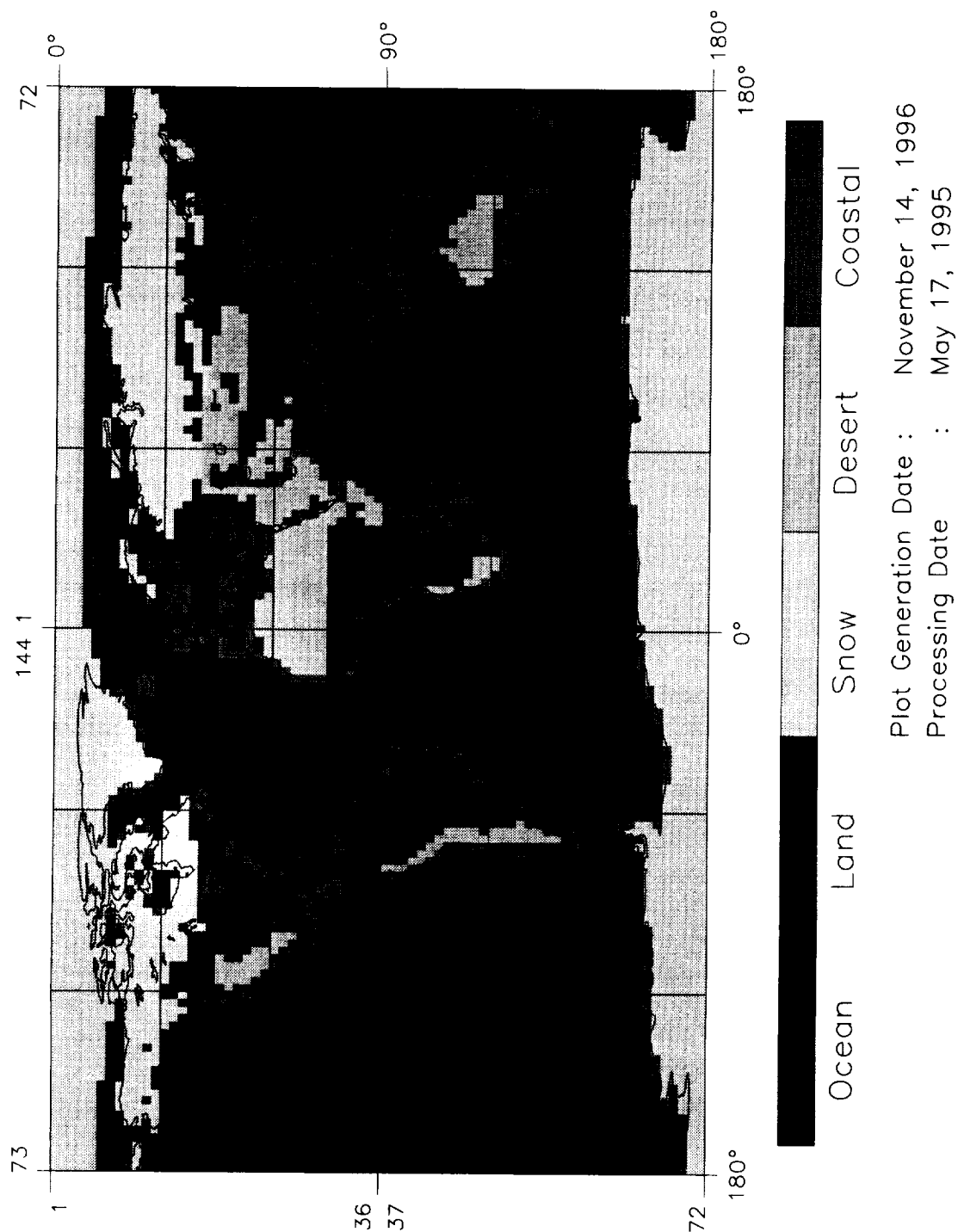
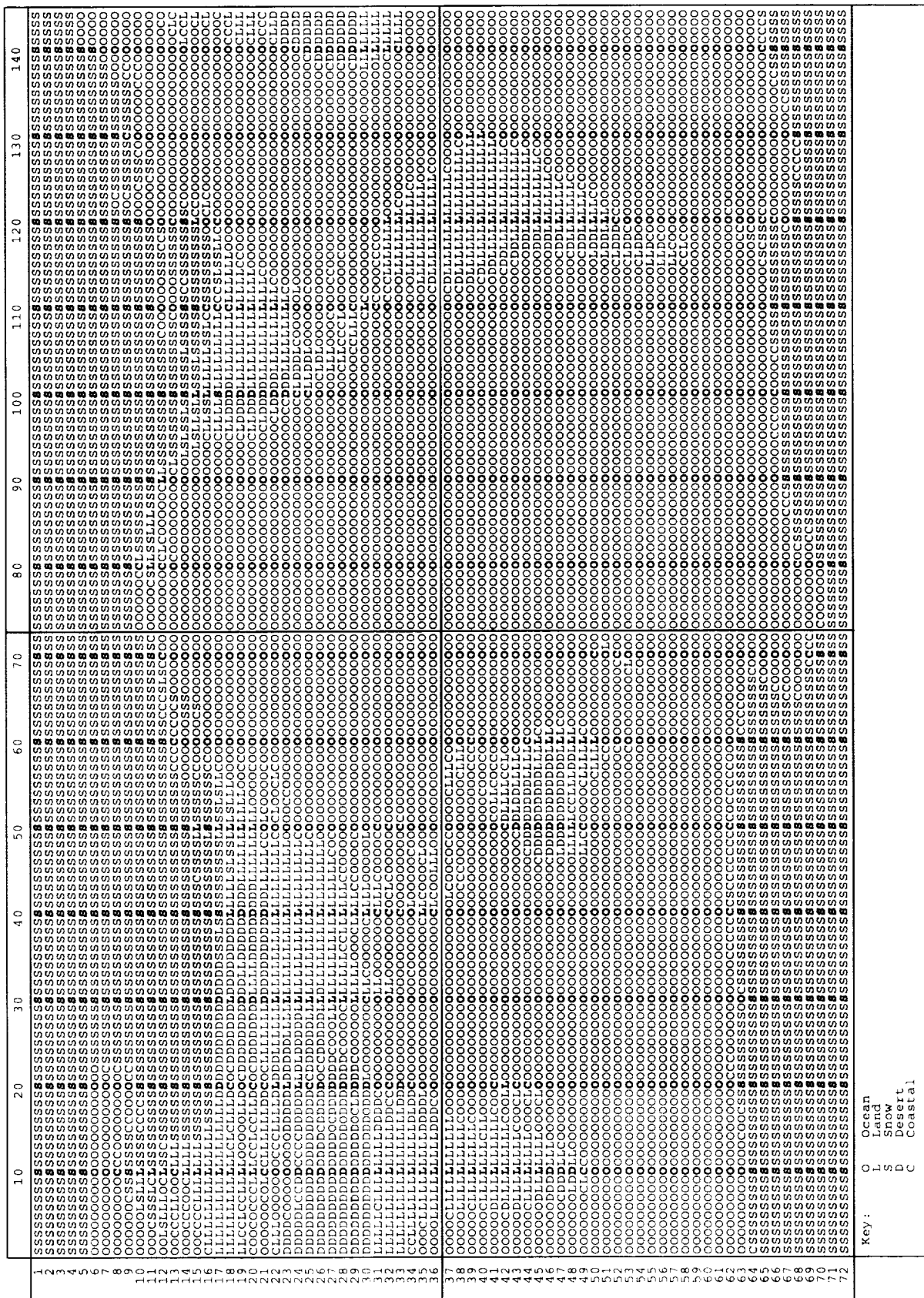
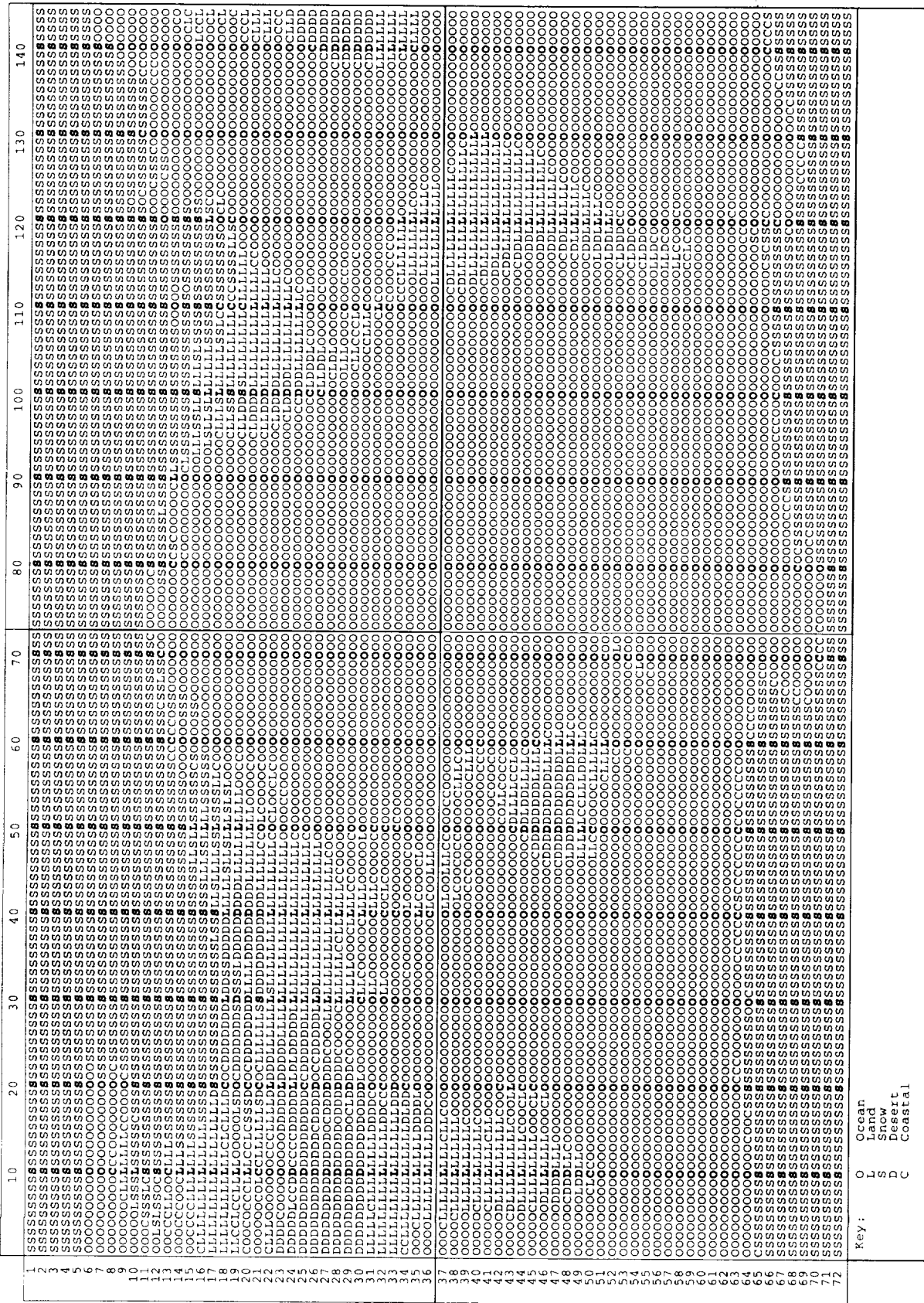


Figure 14. Composite Geo-Scene Map (December 1985-1989)





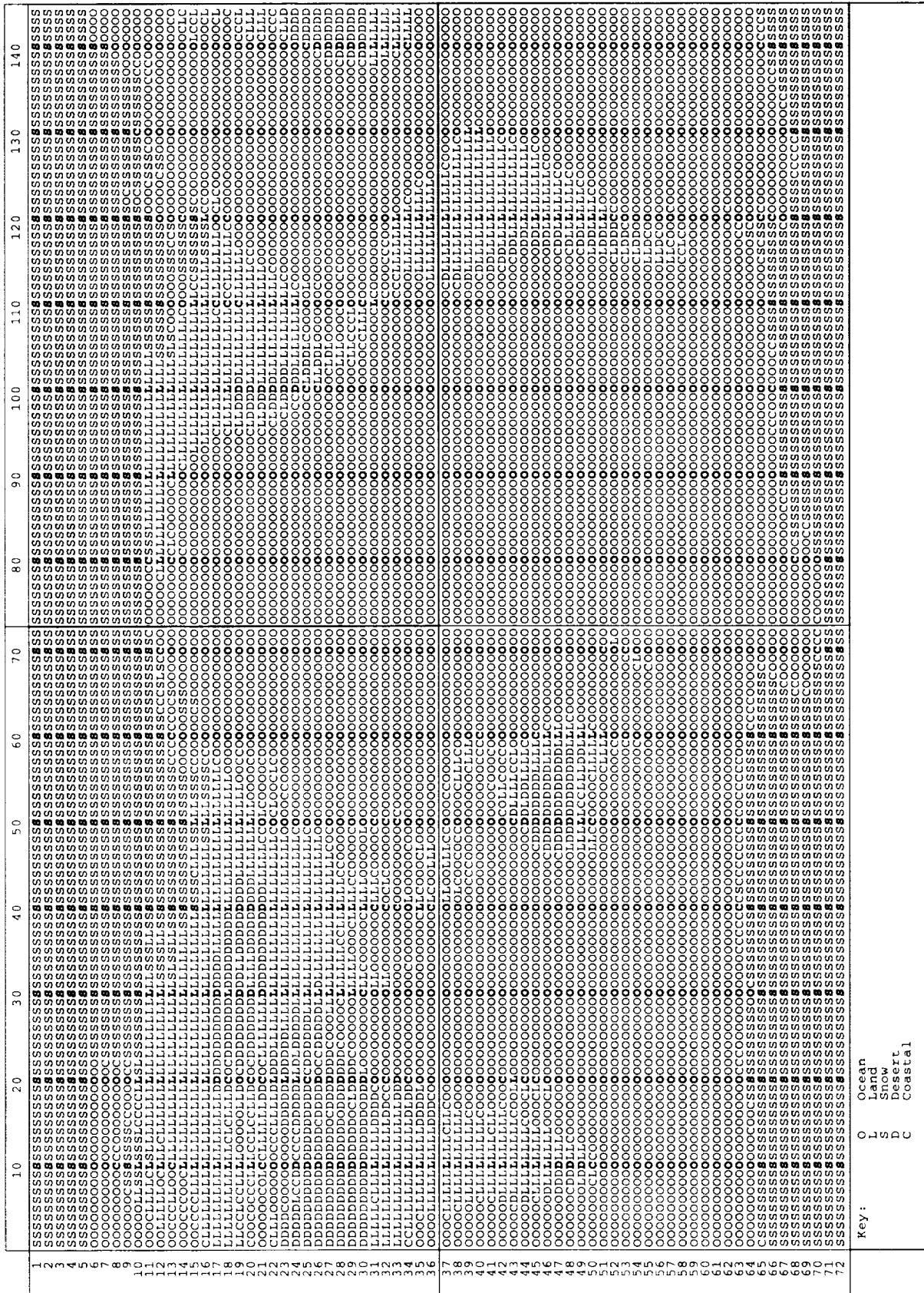


Figure 17. Composite Geo-Scene Map, Character Representation, for March
 $0^\circ \leq \text{Colatitude} \leq 180^\circ$ and $0^\circ \leq \text{Longitude} \leq 360^\circ$

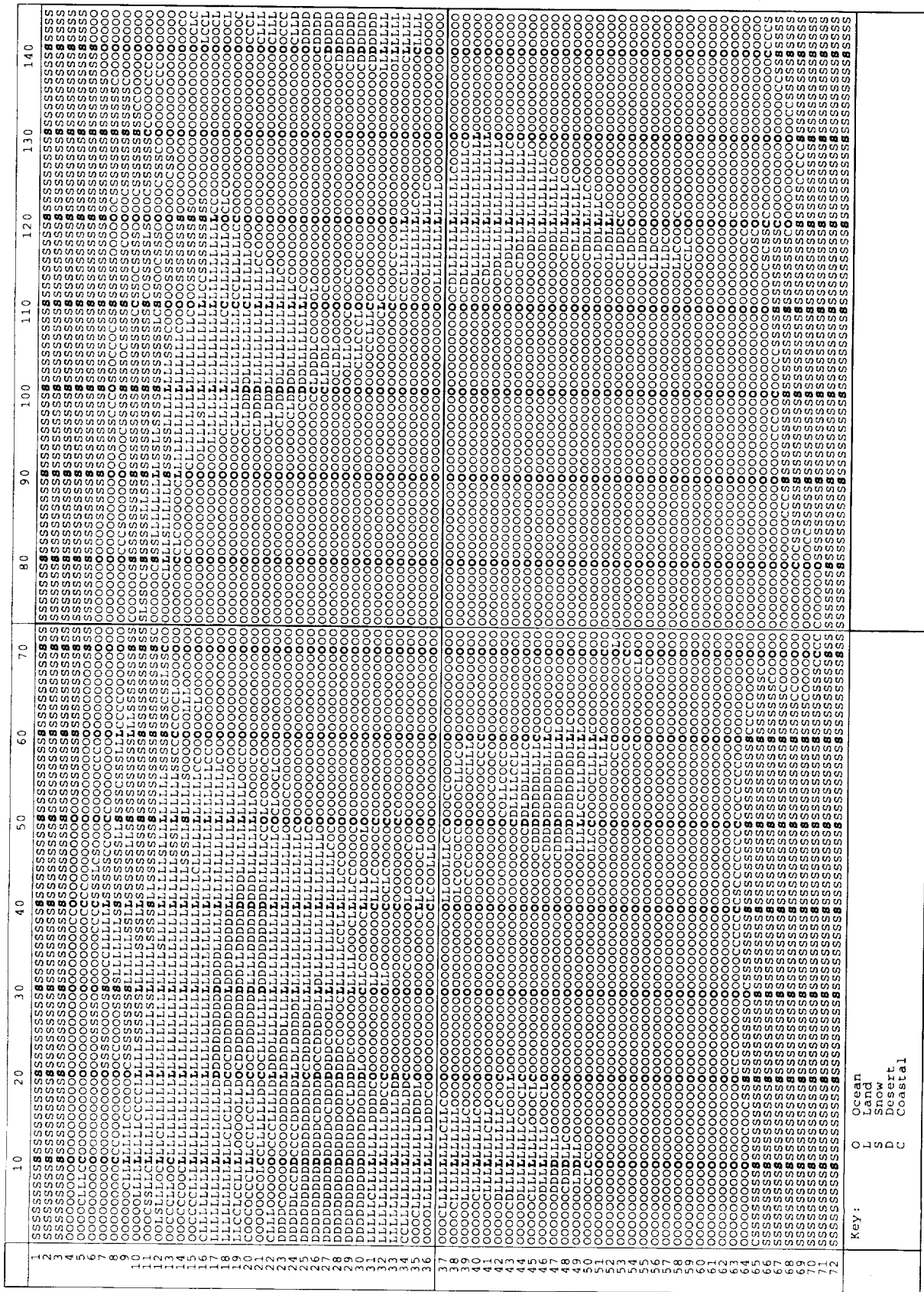
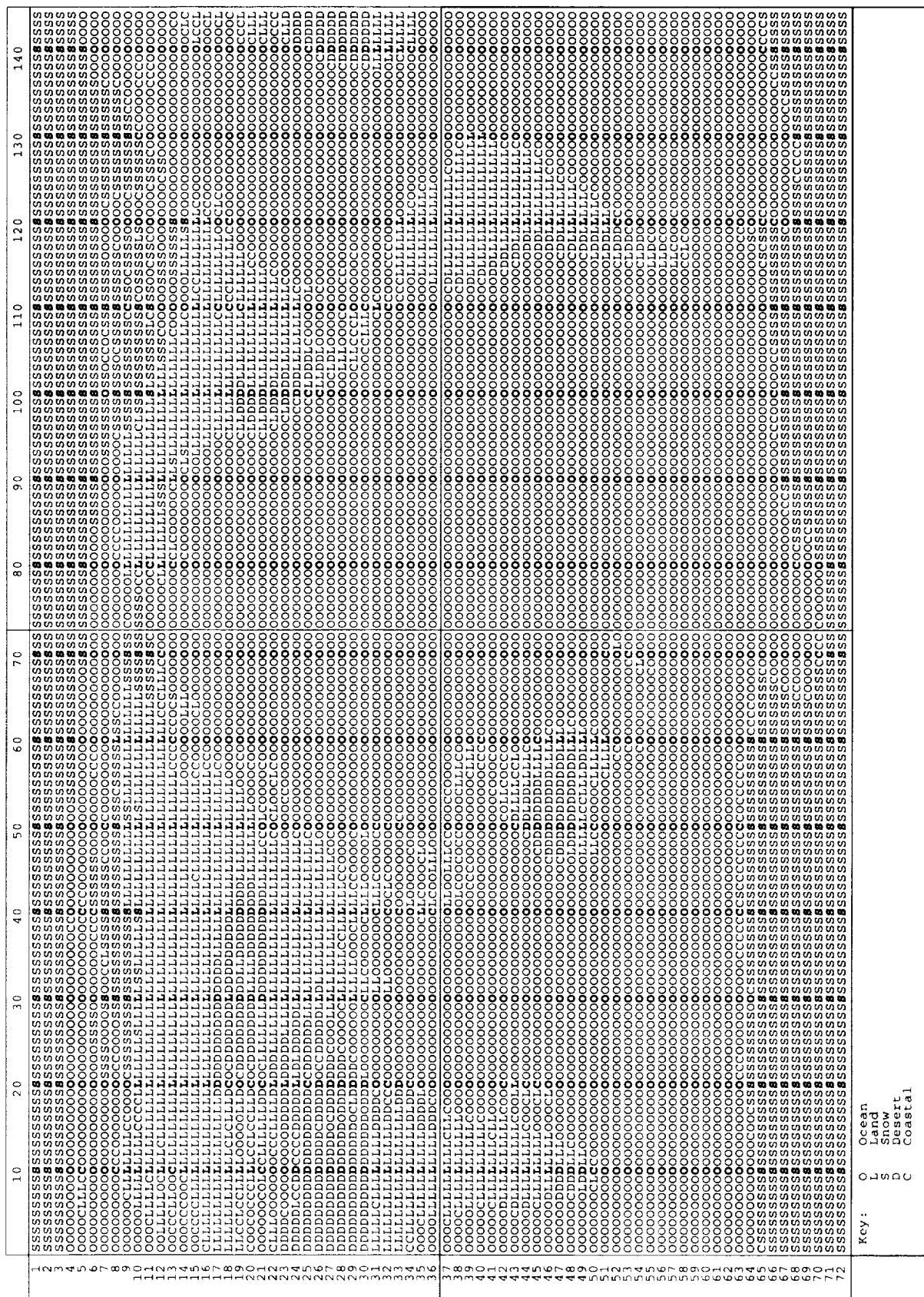
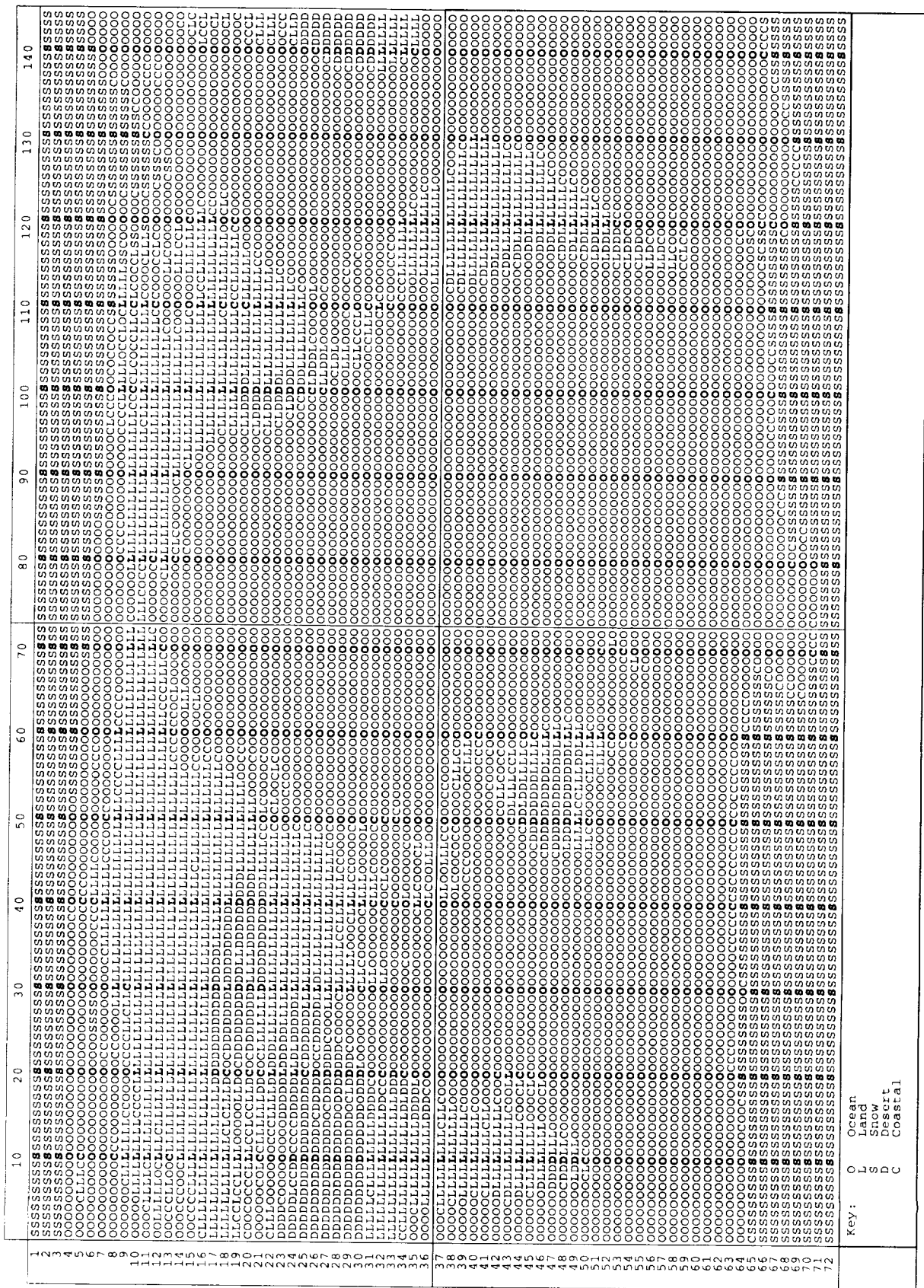


Figure 18. Composite Geo-Scene Map, Character Representation, for April
 $0^{\circ} \leq \text{Colatitude} \leq 180^{\circ}$ and $0^{\circ} \leq \text{Longitude} \leq 360^{\circ}$





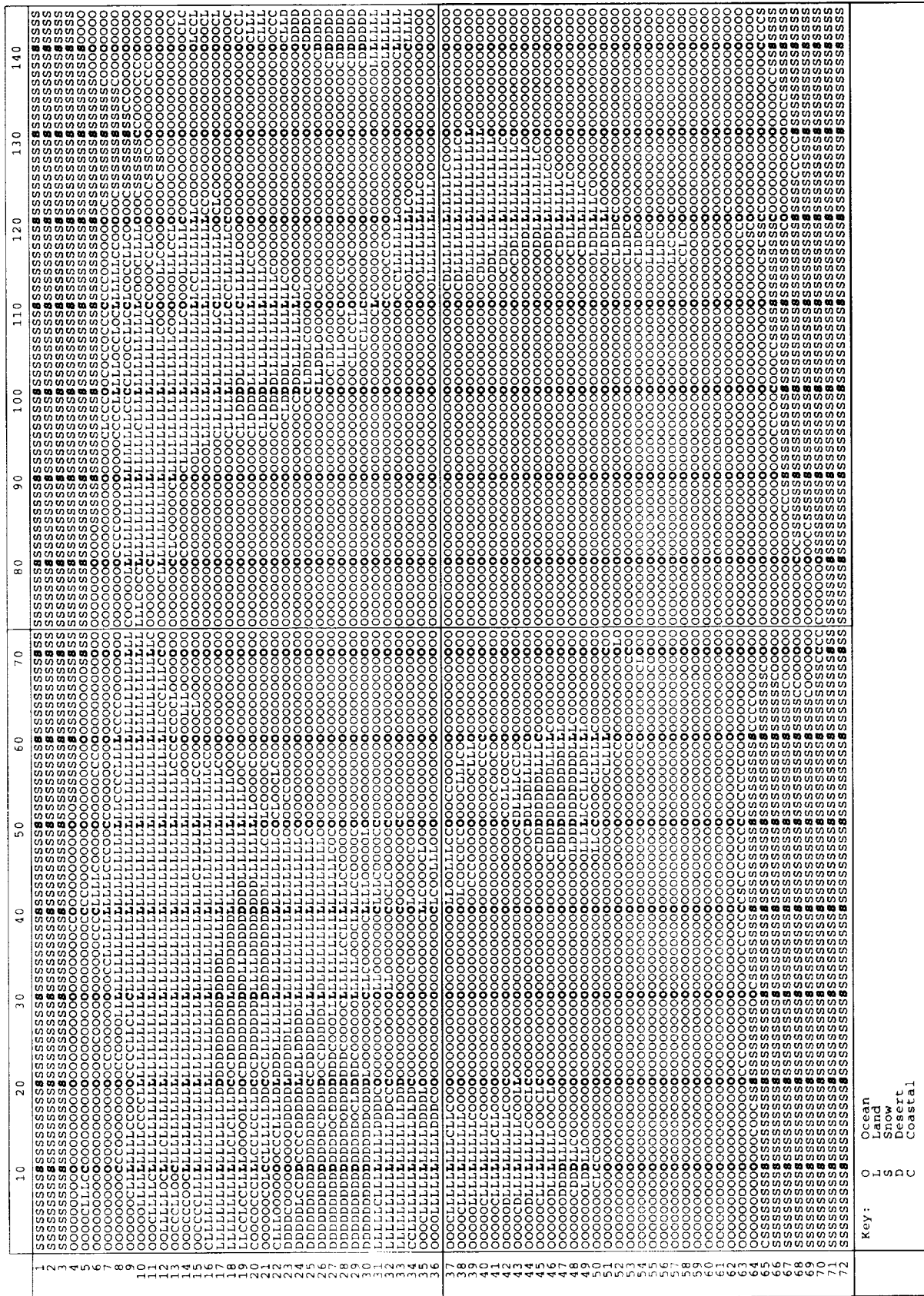


Figure 21. Composite Geo-Scene Map, Character Representation, for July
 $0^{\circ} \leq \text{Colatitude} \leq 180^{\circ}$ and $0^{\circ} \leq \text{Longitude} \leq 360^{\circ}$

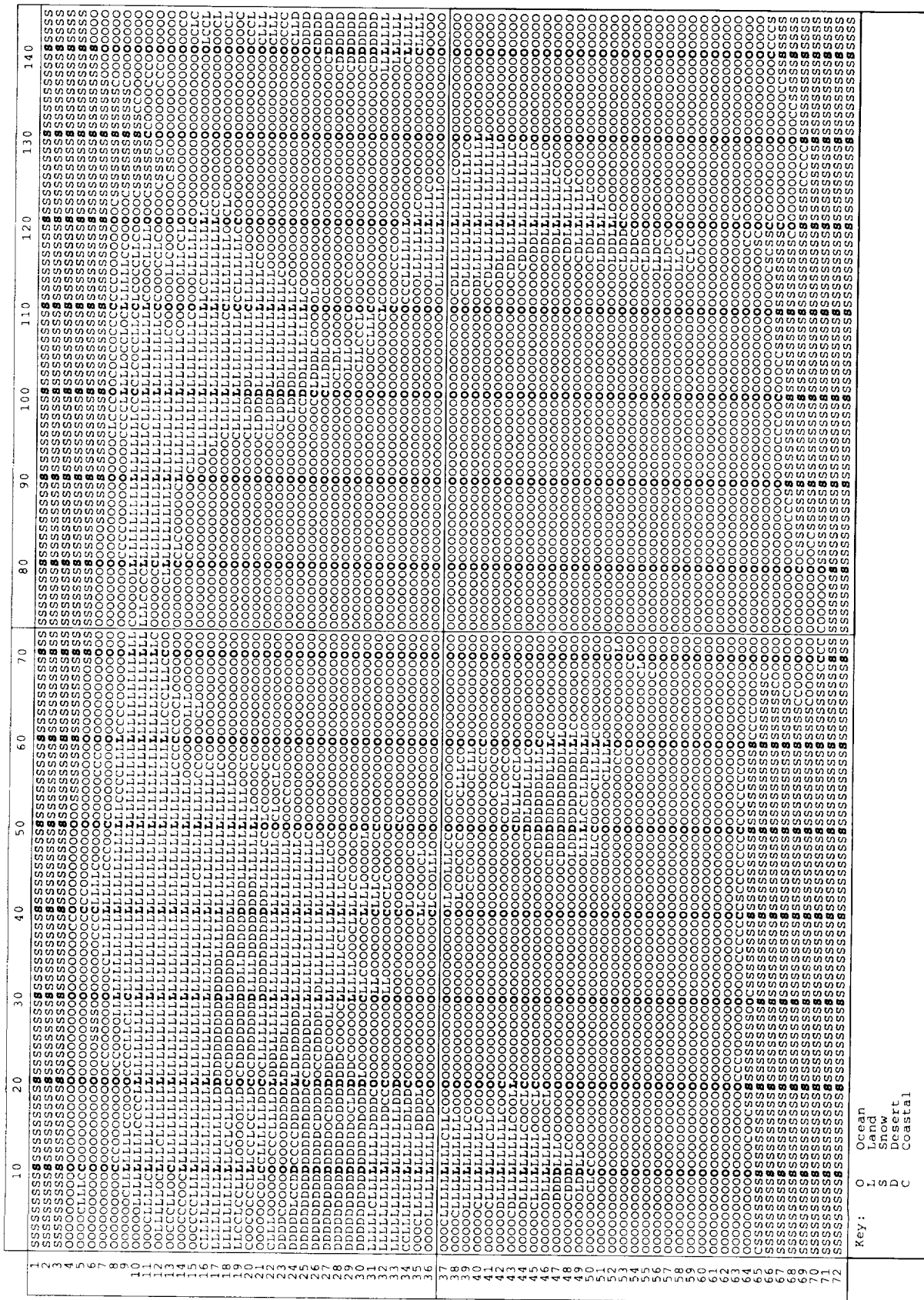


Figure 22. Composite Geo-Scene Map, Character Representation, for August
 $0^{\circ} \leq \text{Colatitude} \leq 180^{\circ}$ and $0^{\circ} \leq \text{Longitude} \leq 360^{\circ}$

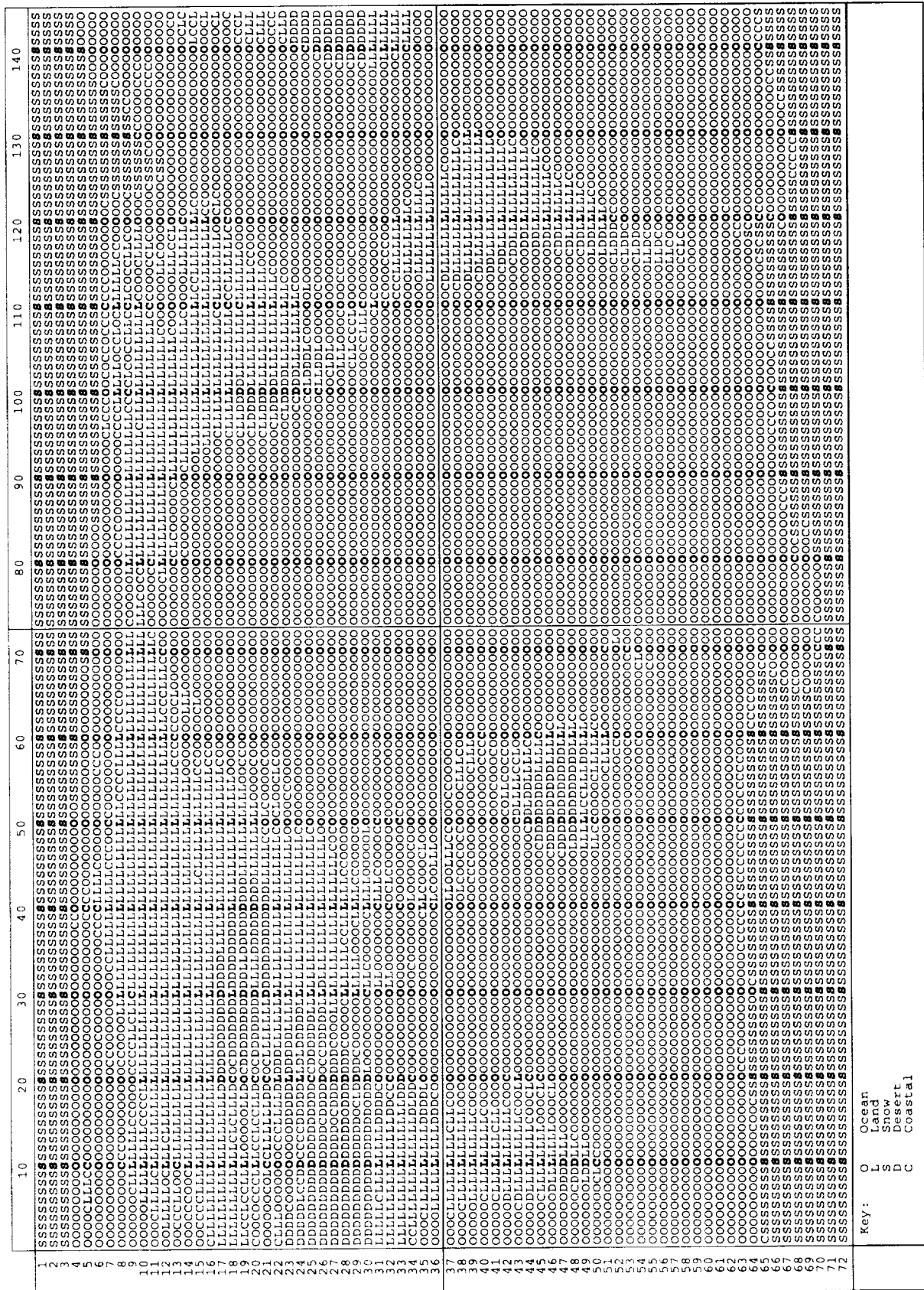
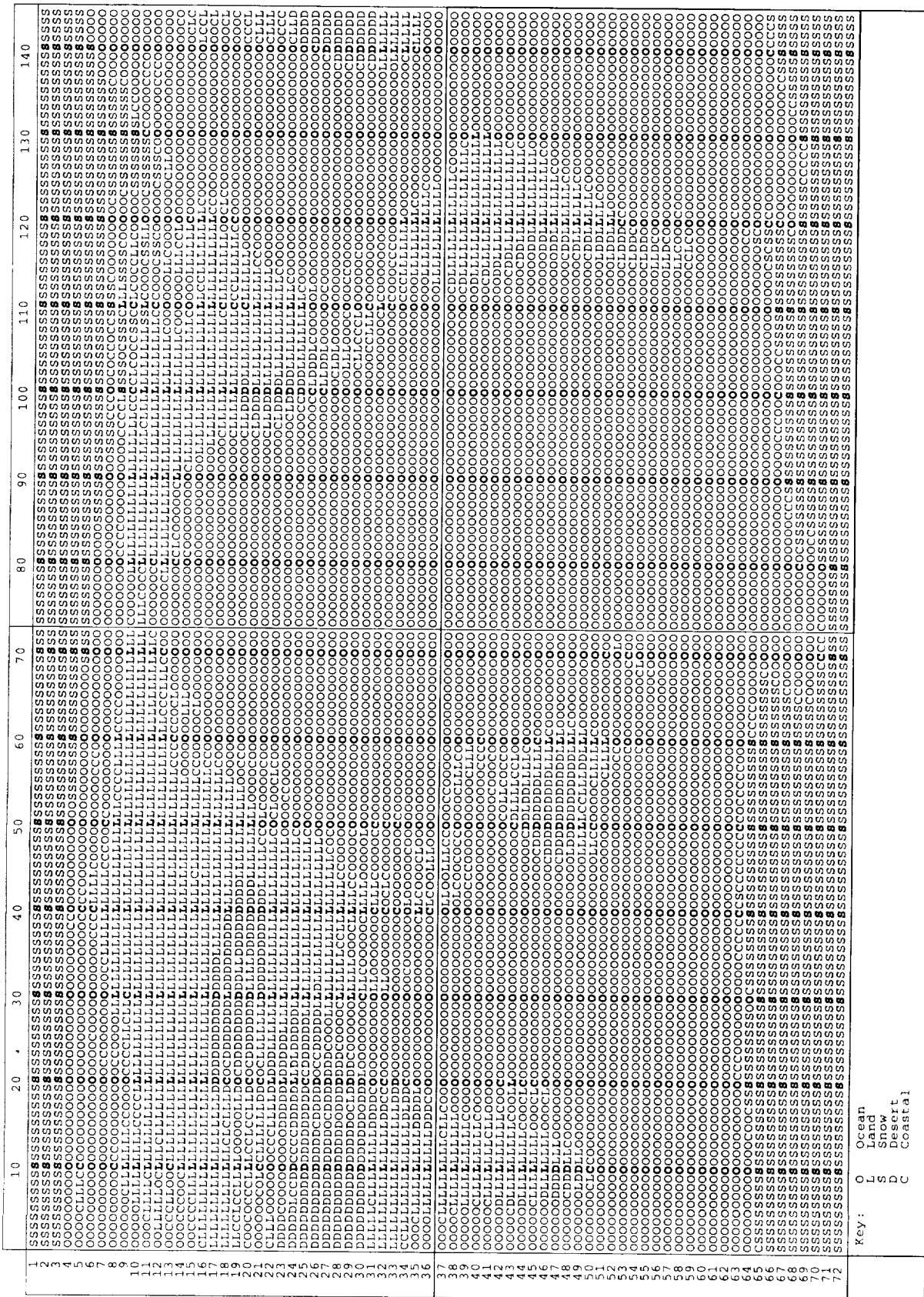


Figure 23. Composite Geo-Scene Map, Character Representation, for September
 $0^\circ \leq \text{Colatitude} \leq 180^\circ$ and $0^\circ \leq \text{Longitude} \leq 360^\circ$



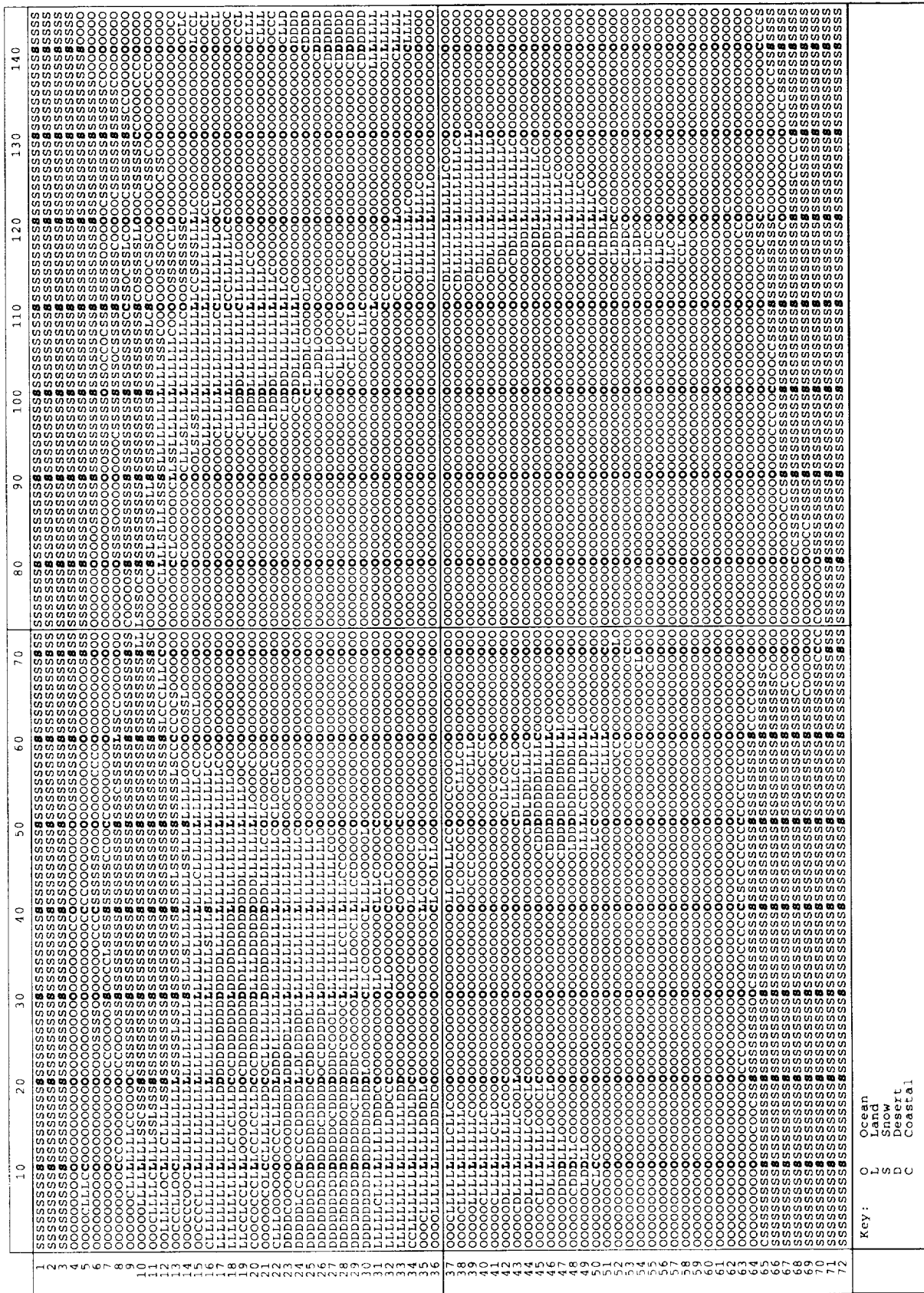


Figure 25. Composite Geo-Scene Map, Character Representation, for November
 $0^{\circ} \leq \text{Colatitude} \leq 180^{\circ}$ and $0^{\circ} \leq \text{Longitude} \leq 360^{\circ}$

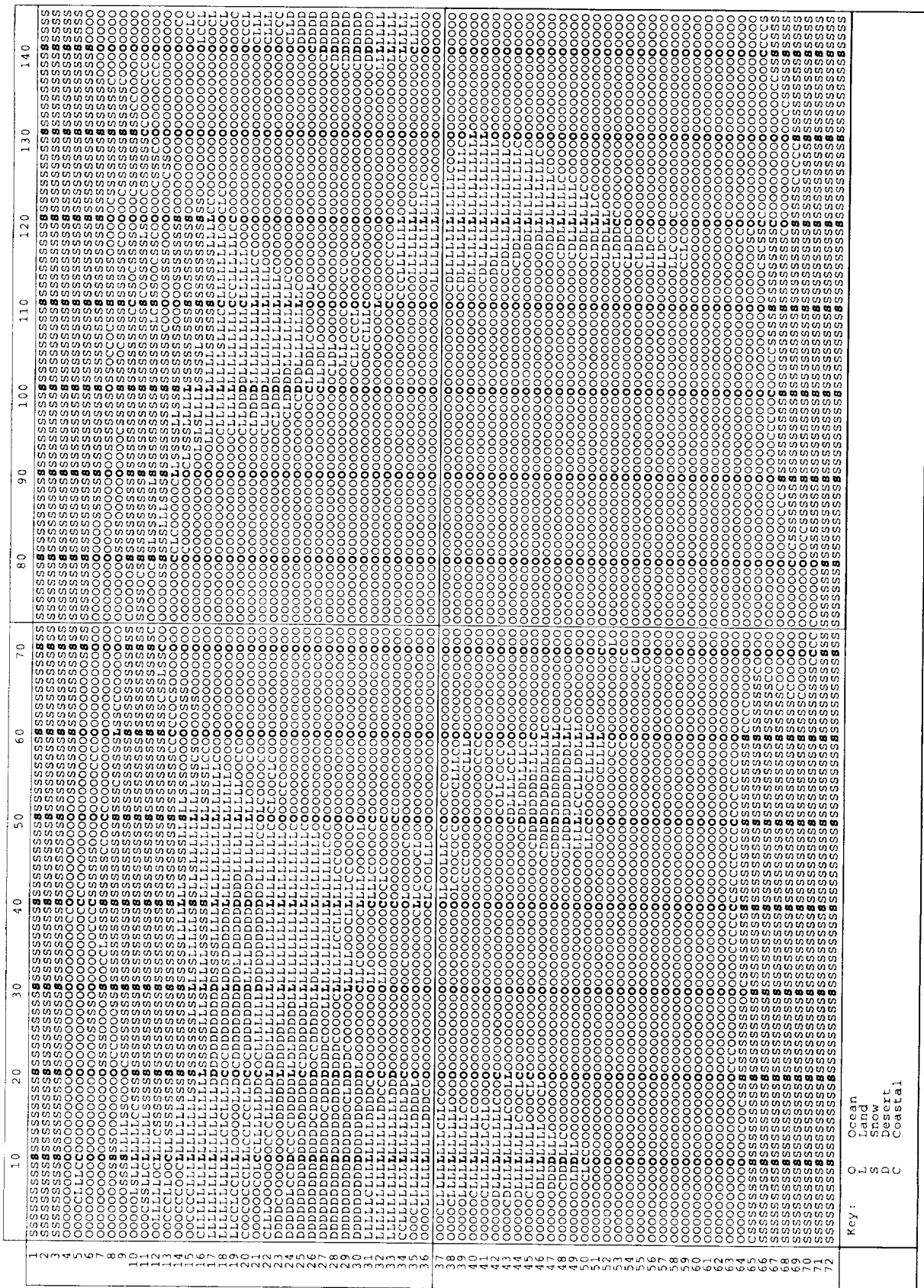


Figure 26. Composite Geo-Scene Map, Character Representation, for December
 $0^\circ \leq \text{Colatitude} \leq 180^\circ$ and $0^\circ \leq \text{Longitude} \leq 360^\circ$

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Acronyms

ADM	Angular Distribution Model
ASD	Atmospheric Sciences Division
DAAC	Distributed Active Archive Center
ERBE	Earth Radiation Budget Experiment
NASA	National Aeronautics and Space Administration
NCAR	National Center for Atmospheric Research
NESS	National Environmental Satellite Service
NOAA	National Oceanic and Atmospheric Administration

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13. ABSTRACT (Maximum 200 Words) The Earth Radiation Budget Experiment (ERBE) is a multisatellite system designed to measure the Earth's radiation budget. The ERBE data processing system consists of several software packages or sub-systems, each designed to perform a particular task. The primary task of the Inversion Subsystem is to reduce satellite altitude radiances to fluxes at the top of the Earth's atmosphere. To accomplish this, angular distribution models (ADMs) are required. These ADMs are a function of viewing and solar geometry and of the scene type as determined by the ERBE scene identification algorithm which is a part of the Inversion Subsystem. The Inversion Subsystem utilizes 12 scene types which are determined by the ERBE scene identification algorithm. The scene type is found by combining the most probable cloud cover, which is determined statistically by the scene identification algorithm, with the underlying geographic scene type. This Contractor Report describes how the geographic scene type is determined on a monthly basis.				
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